Senior 4 Applied Mathematics (40S)
Standards Test

Administration Manual for Supervising Teachers

January 2002

Manitoba
Education,
Training
and Youth

Preface

This *Administration Manual for Supervising Teachers* is distributed to teachers and administrators, and must be read prior to administering the standards test. The rules and guidelines in this manual must be strictly observed to ensure the consistency of standards test administration.

Please use this manual in conjunction with the registration package, the *Policies and Procedures for Standards Tests* handbook and the *Information Bulletin* to gain a full understanding of the protocols and procedures associated with this test. This manual contains general information about the test, step-by-step instructions for each day of the test administration, and policies regarding absenteeism, lateness, violation of rules, etc.

If you encounter exceptional circumstances not addressed in this manual, or if you have further inquiries, contact Aline Sveinson, Administrative Officer, at 945-5862, or toll-free at 1 800 282-8069, extension 5862.

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General Information

Manitoba Education, Training and Youth develops all standards tests in collaboration with teachers from across the province. This standards test is based on the *Senior 4 Applied Mathematics: A Foundation for Implementation (2000)*.

The standards test is locally marked and counts for 30% of each student's final grade in the course. Marking instructions are provided by the department immediately following test administration. Student results on the test will be released to students according to local policy on the date designated by local jurisdictions.

All students enrolled in Senior 4 Applied Mathematics (40S), except those who have been exempted, must write the Senior 4 Applied Mathematics (40S) Standards Test on January 23 and 24, 2002. Please note that all students repeating the Senior 4 Applied Mathematics (40S) course must write the test, even those who may have previously passed the provincial examination.

Students are expected to write the standards test as scheduled near the end of the semester in which they take the course (i.e., January for first-semester courses, June for second-semester and full-year courses).

All schools should receive the test materials by January 15, 2002. Principals of public schools receive test materials from their division/district offices. Principals of independent and band-operated schools will receive test materials directly from the Assessment and Evaluation Branch.

School principals will receive Senior 4 Applied Mathematics (40S) Standards Test *Marking Packages* by January 24, 2002. The *Marking Packages* are to be stored in a secure location until 12:30 p.m. the day of the test.

The number of test booklets sent to each school is based on the October 31, 2001 registration information provided by the school. Please advise Aline Sveinson, Administrative Officer, at 945-5862, or toll-free at 1 800 282-8069, extension 5862, immediately if the number of students registered to write the test has increased since registration.

In the context of marking standards tests at the local level, Manitoba Education, Training and Youth will:

- train representatives from local jurisdictions to act as Local Marking Co-ordinators;
- collect and scan all *Answer/Scoring Sheets* (for the Written Test) and *Recording Sheets* (for the Inquiry Task) from jurisdictions to provide them with test result summaries;
- centrally mark a random sample of locally-marked test booklets to provide feedback to jurisdictions on their local marking;
- support provincially-funded local jurisdictions by providing $10.00 for each locally-marked test administered in accordance with the test schedule noted on page 3; and
- be responsible for preparing and distributing standards tests and accompanying materials, and for scanning test results once they have been locally marked.

Features of the test

- The test is comprised of two components: an Inquiry Task and a Written Test.
- English or French versions of the test will be available for students enrolled in Senior 4 Applied Mathematics (40S) and « Mathématiques appliquées de secondaire 4 (40S) ».
- The Inquiry Task component consists of items targeting two curriculum units of the *Senior 4 Applied Mathematics: A Foundation for Implementation (2000)*. This school year for both semesters, the two units assessed by the Inquiry Task are Personal Finance and Design and Measurement.
- The Written Test will assess the remaining six curriculum units and will not include items from the two units already assessed by the Inquiry Task.
- The Inquiry Task comprises 25% and the Written Test 75% of the total marks of the standards test.
- The Inquiry Task requires the use of technology such as computer software and/or a graphing calculator.
- The Written Test requires the use of a graphing calculator although students may use computer software depending on the tools normally used in the classroom for instruction.
- The main characteristic of the Inquiry Task is the investigative nature of the items that require some reflection on the part of the student for problem solving. The Inquiry Task will consist only of Constructed-response items that may range from Restricted-response, Restricted-response with explanation to Open-response items.
- The Written Test will consist of Multiple-choice items as well as Constructed-response items.
- Strict administrative procedures as detailed in this manual need to be followed by the classroom teacher to avoid any compromise to the integrity of the test.

Test schedule

The following table summarizes the schedule for the Senior 4 Applied Mathematics (40S) Standards Test:

Date	Session	Preparation Time	Activity	Time Required for Test
Wednesday, January 23, 2002	1	15 minutes preparation and instructions	Inquiry Task	1.5 hours
Thursday, January 24, 2002	2	15 minutes preparation and instructions	Written Test	2.5 hours

The test must be written between 8:30 a.m. and 12:30 p.m. on Wednesday, January 23, 2002 and Thursday, January 24, 2002.

The total writing time for completing the Inquiry Task is 1.5 hours plus 15 minutes for preparation and instructions and 2.5 hours plus 15 minutes for preparations and instructions for the Written Test.

Policies for Standards Tests

Principals and supervising teachers should be aware that *Policies and Procedures for Standards Tests* handbook has been distributed to all schools and is available at http://www.edu.gov.mb.ca/metks4/curricul/assess/index.html. This handbook outlines current policies and procedures related to the administration of standards tests and reflects the principles and guidelines contained in *Principles for Fair Student Assessment Practices for Education in Canada (1993).*

Adaptations

Schools are asked to identify and submit requests for test adaptations **at the time of student registration**. These requests should be submitted on the *Request for Adaptations Form* included with the registration package. Following departmental review of the adaptation requests received, schools will be advised of the department's decision regarding these requests. (*Policies and Procedures,* Sections 4.0, 4.1 and 4.2)

Exemptions

Decisions for student exemptions that fall within the guidelines set out in *Policies and Procedures* (Sections 5.0, 5.1 and 5.2) are made at the school level and do not require departmental approval. Schools are required, however, to report school-based exemptions on the *Student Exemption Report* included with the registration package. If additional student exemptions are needed after the registration deadline date, an additional *Student Exemption Report* should be submitted as soon as possible.

For exemptions that fall outside the parameters of policy and procedure guidelines, requests should be made **at the time of student registration**. Please submit requests in writing to Ernest Molgat, Director, Assessment and Evaluation Branch, 71–1567 Dublin Avenue, Winnipeg MB R3E 3J5.

Re-read provisions

As the reporting of individual student scores on locally-marked standards tests is the responsibility of each local jurisdiction, the re-read policy for these tests is determined locally. Should a re-read be requested for a test booklet that has been sent to the department as a part of the feedback process, the department will return a photocopy of the test booklet upon request. Please contact Aline Sveinson, Administrative Officer, at 945-5862, or toll-free at 1 800 282-8069, extension 5862.

Return of tests to students

Local jurisdictions decide whether to keep the test booklets or return them to students. The department will return the random sample of test booklets to schools within three months of marking.

Test confidentiality

Test materials must be kept secure and sealed until administration.

After each session, all materials are returned for safe-keeping to the secure area.

Test booklets must not be reproduced nor information from them communicated in any way until test administration is completed.

Student materials

Students may use the following materials during the Senior 4 Applied Mathematics (40S) Standards Test:

- HB lead pencil;
- eraser;
- ruler;
- protractor;
- extra piece of 8 ½ × 11 blank paper provided by the classroom teacher during the test sessions upon request;
- graphing calculator; and
- computer software for either the Written Test or Inquiry Task session.

Students are not permitted to exchange materials during the test.

The following materials must **not** be used during the test:

- personal notes;
- textbooks; or
- dictionaries.

Students leaving the room

Students are expected to remain in the room for a minimum of 60 minutes from the start of each test session.

However, any student who must leave and re-enter the room should be accompanied by a replacement supervisor. This practice ensures that the supervising teacher can remain in the test room with the students at all times.

Late arrivals

Students who arrive more than one hour after the test has started will not be allowed to write the test. Students who arrive late but within the first hour of the test will be allowed to write. In this case, the student will be allowed additional time corresponding to the amount of time by which the student was late.

Student absences

Standards tests cannot be written at a later date and reported as a standards test result. Therefore, schools have the responsibility to provide a final mark to absent students. The final mark for these students must be identified as a school-based assessment and evaluation practice only. (See *Policies and Procedures,* Sections 6.0, 6.1 and 6.2, for additional information.)

Responding to student questions

Avoid making any directing/guiding comments during the test, other than those required for distribution of materials and instructions to students.

No explanations, translations, rephrasing, clarifying statements or comments of a similar nature may be provided about the test content.

If a student asks a question related to test content, a suggested response is, "I'm sorry. I can't answer your question. Do your best with it."

Suspected errors in printing or wording should not be communicated to students unless specific instructions are received from the Assessment and Evaluation Branch.

Violation of rules

The *Inquiry Task Session Rules* or the *Written Test Session Rules* are read aloud to students by the supervising teacher immediately before each session of the test. (See Appendices 1 and 2, p. 17 and 18.)

Document any violation of rules on the *Supervising Teacher Report*. This documentation should include:

- the test booklet number;
- a description of the circumstances, including available evidence.

The student may be permitted to complete the test.

The consequences of any violation of rules is a local decision.

Defective materials

Students should be assured that they will not be penalized for any obvious error in printing or wording. Local Marking Co-ordinators will be advised of any known errors before the marking session. Return the unused damaged booklet(s) with the reports and forms being sent to the department immediately after the final test session.

On test administration date

If a damaged or imperfectly printed test booklet is discovered **at the start** of the test session:

- replace the defective test booklet with a new test booklet; and
- print "DAMAGED" on the test booklet cover and on the *Attendance Form*.

During test administration

If a damaged or imperfectly printed test booklet is discovered **during** the writing of the test:

- give the student a new test booklet (the student keeps the damaged test booklet until the end of the session);
- instruct the student to continue responding to test items in the new test booklet;
- collect both test booklets at the end of the test session;
- cross out the existing booklet number on the undamaged test booklet and change it to the original booklet number so that **all student responses are recorded under the original booklet number**;
- indicate on the *Attendance Form* that two booklets have been used for one student (see Appendix 4, p. 20);

- record the defective test booklet number on the *Supervising Teacher Report*; and
- ensure both booklets are kept together by bundling with an elastic band.

Responsibilities of School Principals

It is the responsibility of the principals to ensure that the tests are kept confidential until test administration is completed.

Other responsibilities are listed below.

If tests are not in your school by January 15, 2002:

- public school principals should contact their superintendent;
- principals of independent and band-operated schools should contact Aline Sveinson, Administrative Officer, at 945-5862, or toll-free at 1 800 282-8069, extension 5862.

Use the *Packing List* to confirm that all materials have been received. Count the shrink-wrapped test booklets to ensure that there are enough booklets for the number of students writing the test. Keep the shrink-wrapped test packages unopened until the morning of the test. If additional test materials are needed, immediately contact Aline Sveinson, Administrative Officer at the number noted above.

Please note that the shrink-wrapped test bundles are divided into two packages. The Inquiry Task package should be opened on January 23, 2002 in preparation for the beginning of the Inquiry Task session.

The Written Test package should remain unopened in a secure location until the morning of January 24, 2002, at which time the Written Test will be administered.

Store test materials in a secure area in the school.

Provide supervising teachers with a listing of the Manitoba Education, Training and Youth (MET) numbers for the students registered to write the test. Call the Professional Certification and Student Records Unit at 1 800 667-2378 to obtain MET numbers for new students.

Make arrangements to meet the requirements of the adaptations approved for your students (see Adaptations, p. 3 and *Policies and Procedures,* Sections 4.0, 4.1 and 4.2).

Co-ordinate test scheduling and space requirements.

Minimize the frequency of school announcements during the test sessions.

Ensure that a replacement supervisor is available to accompany students who must temporarily leave the room.

Provide the test materials to the supervising teacher on each morning of the test.

Advise the Assessment and Evaluation Branch of school closures or suspended school bus transportation services that occur on the test dates as a result of unusual or extenuating emergency circumstances or extreme inclement weather conditions. Please contact Marie-Josée Gendron, Assessment Consultant, at 945-5136 or toll-free at 1 800 282-8069, extension 5136.

Complete the *Principal Feedback Form* before the end of the final test session.

Responsibilities of Supervising Teachers

Supervising teachers administer the test using the step-by-step procedures outlined in the following section ("Checklist of Procedures") in this manual.

Points to Remember

- Remain in the classroom throughout the entire test session and engage in work solely related to the duties of supervising the test.
- A replacement supervisor must be available to assist you.
- Store all documents not in use in a secure area in the school.
- Ensure that once a booklet number has been assigned to a student, all materials distributed to that student have the same booklet number.
- Students may **not** have access to their test booklets between sessions, and may **not** bring anything produced outside of class into the test sessions.
- Students may not review or complete work from any previous session.

In the "Checklist of Procedures", shaded areas indicate the step is not applicable for that session.

Checklist of Procedures

Session 1	Session 2	
		Advance Preparations
		1. Check with your principal to ensure that: • appropriate scheduling and space allocation for the test has occurred; • the test materials itemized on the *Packing List* have been inventoried; • a replacement supervisor is available to accompany students who must temporarily leave the room during the test; • arrangements have been made to accommodate the adaptations approved for students; and • a list of MET numbers for students writing the test is available.
		2. Ensure that all subject-related materials have been removed from the walls and boards.
		3. Notify students in advance of the: • time, location and duration of each test session; • materials needed to write the test; • *Inquiry Task Session Rules* and the *Written Test Session Rules* (see Appendices 1 and 2, p. 17 and 18); and • requirement to remain in the test session for at least 60 minutes.
		4. Ensure that you have extra supplies and that there is a functioning pencil sharpener and stapler in the room. Students must not exchange materials during the test.
		5. If there is more than one teacher supervising the test, photocopy the *Supervising Teacher Report* and *Supervising Teacher Feedback Form*.
		6. Review the sample forms in the Appendices.
		Prior to the test session
		1. Ensure that your materials are available:
		• *Packing List*;
	■	• *Senior 4 Applied Mathematics (40S) Standards Test—Inquiry Task* booklets;
■		• *Senior 4 Applied Mathematics (40S) Standards Test—Written Test* booklets;
		• *Attendance Forms* (enclosed with shrink-wrapped test booklets);
		• *Student Registration Update*;
	■	• extra copies of Inquiry Task booklets (four extras);
■		• extra copies of Written Test booklets (four extras);
		• *Demographic Data Forms*;
■		• *Answer/Scoring Sheets* (for the Written Test);

Session 1	Session 2	
	■	• *Recording Sheets* (for recording marks for the Inquiry Task) (Keep in a secure location and forward to marking site with test materials on January 24, 2002);
		• *Supervising Teacher Report*;
		• *Supervising Teacher Feedback Form*;
		• *Principal Feedback Form* (this must be given to the principal and collected before returning materials);
		• *Administration Manual for Supervising Teachers* (this document); and
		• postage-paid envelope for return of materials to the Assessment and Evaluation Branch.
		2. Before opening the shrink-wrapped packages, ensure that you have the appropriate test booklets for the program being taught (e.g., French Immersion).
		3. Count the number of *Senior 4 Applied Mathematics (40S) Standards Test—Inquiry Task* booklets (Day 1) and *Written Test* booklets (Day 2). The number of test booklets should equal the number requested by the school plus the additional booklets. The number of booklets should also be identical to the number on the *Packing List*. If you need to split a bundle of booklets between classrooms, make a photocopy of the *Attendance Form* enclosed with the bundle. **On your copy**, cross out the test booklet numbers that are not used in your classroom.
		4. Arrange the desks so they are spaced as far apart as possible.
		5. Ensure that students exempted from writing the test are not present.
		Beginning the test session
		1. Distribute:
	■	• *Senior 4 Applied Mathematics (40S) Standards Test—Inquiry Task* booklet
■		• *Senior 4 Applied Mathematics (40S) Standards Test—Written Test* booklet
■		• *Answer/Scoring Sheets*
		• *Demographic Data Forms*
	■	2. Remind students to check that the number on the *Answer/Scoring Sheet* corresponds to the number on their *Senior 4 Applied Mathematics (40S) Standards Test—Inquiry Task* booklet.
		3. Tell students that while they are working you will:
		• be circulating the *Attendance Form* so they can print their names beside their test booklet number;
		• tell them and write on the board the time and location of the Written Test.
■		4. Ensure that each student receives the correct test booklet by verifying that the test booklet number corresponds to the student name recorded on the *Attendance Form*.

Session 1	Session 2	
	■	5. Read instructions for completing *Demographic Data Forms* printed on the top left corner. Direct students to print and shade in all the information requested on the *Demographic Data Form*. Remind students of the importance of accurately recording the program (English, French Immersion or Français) they are now in.
		6. Collect the *Demographic Data Forms*.
	■	7. Read aloud *Inquiry Task Session Rules* (Appendix 1, p. 17) to students.
■		8. Read aloud *Written Test Session Rules* (Appendix 2, p. 18) to students.
	■	9. Read aloud "Description" and "Test Resources and Directions" from Inquiry Task booklet to students (page 3 in test booklet).
■		10. Read aloud "Description" and "Test Resources and Directions" from Written Test booklet to students (inside cover in test booklet).
		11. Remind students to:
		• pace themselves in writing the test;
■		• use the *Answer/Scoring Sheet* for responding to multiple-choice questions; and
		• check over their work to ensure that all questions have been attempted.
		12. **Instruct students to turn the page and begin. Record the start time on the *Supervising Teacher Report.***
		During the test session
		1. Supervise the completion of the *Attendance Form* by ensuring that students print their name beside their test booklet number. Under "Student Attendance During Test Sessions", record a "✓" for present. The names of absent students should be written on the *Attendance Form* so that these students will have a booklet number for the Written Test session of the test. Indicate that the student is absent by recording an "A" on the *Attendance Form* (see *Sample Attendance Form*, Appendix 4, p. 20). **Note:** This is the only record connecting students' identities to their Senior 4 Applied Mathematics (40S) Standards Test booklet.
■		2. Ensure that each student absent for the first test session completes a *Demographic Data Form.*
		3. Verify that all the information on each *Demographic Data Form* is accurately printed and shaded. Place all used forms in numerical order (by booklet number) followed by any unused forms in the labelled envelope provided. Do not use elastic bands, staples or paper clips on these forms as they may damage the sheets. Do not seal the envelope.
	■	4. Ensure that each student has recorded the correct test booklet number by verifying that the test booklet number corresponds to the student name on the *Attendance Form.*
		5. Half-way through the test session, advise students of the amount of time remaining by making an announcement and writing the remaining time on a board.

Session 1	Session 2	Ending the test session
■		1. Have students place their *Answer/Scoring Sheet* inside the front cover of the test booklet. Extra paper printed out or used by a student must be stapled in the booklet at the appropriate page.
		2. As students submit their test materials, ensure that each test booklet number matches the information on the *Attendance Form*, the *Demographic Data Form* and the *Answer/Scoring Sheet* (as applicable) (e.g., cross-reference student name and test booklet number). Each student must have the same booklet number on all test materials.
		3. Place a check "✓" on the *Attendance Form* in the "Booklet Submitted to LMC* for Marking" column.
		4. **Record the time students finish writing the test on the *Supervising Teacher Report*.** Do not include extra time given for late arrivals or adaptations.
		5. Stack the test booklets in numerical order.
■		6. If marking is to be conducted at a central location, place all used *Answer/Scoring Sheets* in numerical order followed by any unused forms. Place these forms in the labelled envelope provided. Do not seal the envelope.
■		7. Complete the *Supervising Teacher Report*. Note any unusual circumstances on this report.
		8. Ensure that the number of check marks in the "Booklet Submitted to LMC* for Marking" column on the *Attendance Forms* matches your count of the booklets and *Answer/Scoring Sheets* (as applicable) for submission.
■		9. Complete and check the *Student Registration Update* form. Use the reason codes (Appendix 5, p. 21) provided.
		10. Make one or two copies of the *Attendance Forms* and *Supervising Teacher Report*. One copy must be retained by the school and one forwarded to the local marking site, if a centralized model is used.
■		11. Collect the *Principal Feedback Form*.
■		12. Complete the *Supervising Teacher Feedback Form*.
		13. Return all test booklets and other test-related materials to the **secure area** in the school until commencement of marking or until materials are to be forwarded to local marking site.
■		14. Send materials according to the instructions on the following pages.

* Local Marking Co-ordinator

Submitting Materials on January 24, 2002 (the end of the test)

It is essential that the following materials are packaged and forwarded to the local marking site immediately after completion of the test if a centralized model is used.

- **All used** test booklets;
- **All used** *Answer/Scoring Sheets*;
- All *Recording Sheets*;
- Copy of the *Attendance Forms*; and
- Copy of the *Supervising Teacher Report*.

All other documentation should be verified and returned to the Assessment and Evaluation Branch after the final test session. Use the envelope provided to return:

- *Attendance Forms*;
- **All used** *Demographic Data Forms* (in envelope provided);
- *Student Registration Update*;
- *Supervising Teacher Report*;
- *Supervising Teacher Feedback Form*;
- *Principal Feedback Form*; and
- All damaged or misprinted booklets.

Schools in the City of Winnipeg return their envelopes to the Assessment and Evaluation Branch in the following way. Internet Courier is scheduled to pick up envelopes between **1:00 p.m. and 4:00 p.m.** on **January 24, 2002**. If your envelope will not be ready for pick up during these hours, call Internet Courier (668-5552) to make alternate arrangements.

Schools outside the City of Winnipeg return their envelopes to the Assessment and Evaluation Branch by taking them to the post office. See page 14 for instructions on how to use the Bill of Lading.

Submitting Materials by February 6, 2002 (after local marking)

When local marking is done at a central location, the Local Marking Co-ordinator is responsible for sending the materials to the Assessment and Evaluation Branch. When local marking is done at the classroom level, the teacher is responsible for sending the materials to the Assessment and Evaluation Branch.

After local marking has been completed, prepare a package for return to the Assessment and Evaluation Branch no later than February 6, 2002. Use the set of return labels enclosed with the requested sample of test booklets.

The package must include:

- **All** *Answer/Scoring Sheets* and *Recording Sheets*;

- Test booklets requested by the department for the feedback marking;
- *Sample Request List*; and
- *Local Marking Co-ordinator Feedback Form.*

Jurisdictions within the City of Winnipeg send packages directly to the Assessment and Evaluation Branch via **Internet Courier (668-5552).** The person placing the call should quote **account number ED502,** give the jurisdiction name, address, and the name of the contact person.

Jurisdictions outside the City of Winnipeg return their package by Xpresspost. It is very important to package all materials in **one box or mailing envelope** whenever possible.

After the package(s) is (are) sealed, affix the return labels supplied.

To utilize the **bill of lading**:

1. Sign the "Sender's Signature" section of the bill of lading at the "X";
2. Take your sealed envelope/package and bill of lading to the post office; and
3. The postal clerk will fill in the weight of the envelope/package and prepare the envelope/package for mailing. Ask the postal clerk for the customer receipt and keep it as a record of shipment. If it is necessary to ask Canada Post to trace the envelope/package, your school will be contacted and asked to provide the item number.

We have provided sufficient materials for the return of **one** envelope/package. If you must send a second envelope/package, ask the postal clerk for an additional bar code label to attach to the second envelope/package. Ensure that the bar code number is recorded in the Item ID column. Note that the second envelope/package must be properly addressed to the Assessment and Evaluation Branch.

Appendices

Appendix 1: Inquiry Task Session Rules

Senior 4 Applied Mathematics (40S) Standards Test

The supervising teacher is expected to read these rules aloud to students at the beginning of the Inquiry Task session of the Senior 4 Applied Mathematics (40S) Standards Test:

- Check the title of your test booklet carefully. Make sure that it is entitled *Senior 4 Applied Mathematics (40S) Standard Test—Inquiry Task*. Verify that the test booklet number matches the number you have recorded on your *Demographic Data Form*.
- During this test session, do not proceed until instructed to do so.
- If you receive a damaged or imperfectly printed booklet, return it to receive another booklet.
- You will not be permitted to leave the test room until **one hour** of test time has elapsed. (You may leave before that time in exceptional circumstances such as illness, when accompanied by a supervisor.)
- At the beginning of the session you should have only the test booklet for the Inquiry Task, *Demographic Data Form*, an HB pencil, eraser, ruler, protractor, and your graphing calculator or computer. If you need extra paper to show your work, please raise your hand and I will bring it to you. To write the test, you may use only the materials previously listed. **No** other materials are permitted. Do not exchange test materials.
- You will not give assistance to, nor receive assistance from, another student. If you require something during the test, raise your hand and I will come to you.
- Do not ask questions or request explanations with regard to the content of the questions on the test.
- Do **not** identify yourself or your school, teacher or town in your test booklet.
- When I ask you to stop writing, put your pencil down immediately.
- You may not discard any materials. The test booklet must remain intact except for the perforated *Formula Sheet*. Any extra paper used must be stapled into the test booklet on the appropriate page. You may **not** leave the room with any materials pertaining to the test.

Appendix 2: Written Test Session Rules

Senior 4 Applied Mathematics (40S) Standards Test

The supervising teacher is expected to read these rules aloud to students at the beginning of the Written Test session of the Senior 4 Applied Mathematics (40S) Standards Test:

- Check the title of your test booklet carefully. Make sure that it is entitled *Senior 4 Applied Mathematics (40S) Standard Test—Written Test*. Verify that the test booklet number matches the number on your *Answer/Scoring Sheet*.
- During this test session, do not proceed until instructed to do so.
- If you receive a damaged or imperfectly printed booklet, return it to receive another booklet.
- You will not be permitted to leave the test room until **one hour** of test time has elapsed. (You may leave before that time in exceptional circumstances such as illness, when accompanied by a supervisor.)
- At the beginning of the session you should have only the test booklet for the Written Test, the *Answer/Scoring Sheet*, an HB pencil, eraser, ruler, protractor, and your graphing calculator or computer. If you need extra paper to show your work, please raise your hand and I will bring it to you. To write the test, you may use only the materials previously listed. **No** other materials are permitted. Do not exchange test materials.
- Rough calculations may be done in your booklet on the pages which state: "No marks will be awarded for work done on this page." These pages are located at the back of the test booklet.
- You will not give assistance to, nor receive assistance from, another student. If you require something during the test, raise your hand and I will come to you.
- Do not ask questions or request explanations with regard to the content of the questions on the test.
- Do **not** identify yourself or your school, teacher or town in your test booklet.
- When I ask you to stop writing, put your pencil down immediately.
- You may not discard any materials. The test booklet must remain intact except for the perforated *Formula Sheet*. Any extra paper used must be stapled into the test booklet on the appropriate page. You may **not** leave the room with any materials pertaining to the test.

Appendix 3: Sample Generic Demographic Data Form

Appendix 4: Sample Attendance Form

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ATTENDANCE FORM—January 2002

Senior 4 Applied Mathematics (40S) Standards Test

Booklet Number	Student Name (*Please Print*)	Student Attendance During Test Sessions		Inquiry Task Booklet Submitted to LMC* for Marking (*check ✓*)	Written Test Booklet Submitted to LMC* for Marking (*check ✓*)
		Inquiry Task	Written Test		
10001	Sandra Jones	✓	✓	✓	✓
10002	Kevin Melnychuk	✓	A	✓	
10003	DAMAGED				
10004	Dallas Severn (also 10008)	✓	✓	✓	✓
10005	David Cameron	✓	✓	✓	✓
10006	Robert Smith	A	✓		✓
10007	UNUSED				
~~10008~~	Used with 10004 (damaged)				
~~10009~~	Used in another classroom				
~~10010~~	Used in another classroom				

NOTE: Record a "✓" for Present. An "A" indicates a student is Absent.

Karen Booth

Supervising Teacher's Name (*please print*)

Please ensure that copies of these forms are retained for your records. You will need this form to link your locally marked test with a student's name.

*** Local Marking Co-ordinator**

Appendix 5: List of Reason Codes to Record Changes in Standards Test Student Registration Numbers

(Please use these codes to complete the *Student Registration Update* when returning to the Assessment and Evaluation Branch in JANUARY 2002.)

Absent	
01	arrived too late to write the test
02	did not write due to weather
03	family/personal reasons
04	medical/illness/accident
05	out-of-town activity (athletic/academic)
06	religious objections
07	student refused to write
08	unexcused
09	working
19	other (please specify)

Withdrawn	
22	dropped course
23	incarcerated/court
24	medical/illness/accident
25	family/personal reasons
26	poor attendance/progress
27	quit school
29	other (please specify)

Incomplete	
40	continuing course/program next semester
41	no work completed
49	other (please specify)

Errors in Registration	
20	changed program
21	deceased
50	already has credit
51	auditing the course
52	exchange student
53	registered twice
54	quarter system projected registration
55	registered in wrong grade
59	other (please specify)

Exemptions	
60	emotional/psychological condition or circumstances
61	"M" credit designation
62	"E" credit designation
63	"phase d'accueil—bloc intensif" designation
69	other (please specify)

Drop Ins	
70	forgotten on original test registration
71	late registration to course
72	transferred in from another school/province/country
79	other (please specify)

Migrancy	
90	transferred to another school within the province
91	transferred to another school outside of the province
99	other (please specify)

Senior 4 Applied Mathematics (40S)

Standards Test

Written Test

January 2002

Manitoba
Education,
Training
and Youth

SENIOR 4 APPLIED MATHEMATICS (40S)
STANDARDS TEST

DESCRIPTION

Total Possible Marks: 61 **Time: 2.5 hours**

This test consists of two sections:

	Description	Suggested Time to Complete	Marks
Section A	10 multiple-choice questions worth 1 mark each	20 minutes	10
Section B	15 constructed-response questions worth between 2 and 6 marks each	130 minutes	51

Test Resources and Directions

- Students are provided with the Standard Normal Distribution table and a formula sheet on a detachable sheet on pages 1 and 2 of this booklet.
- Use of a graphing calculator or computer software is allowed.
- Use of protractor and ruler are required.
- Read all instructions on the test carefully.
- Choose the best response and mark it on the *Answer/Scoring Sheet*. Do not fold the *Answer/Scoring Sheet* or the test booklet.
- **If you need more space to answer a question, extra pages may be provided by your teacher, write your booklet ID number and question number on any extra page(s) used and staple it into the booklet where your answer begins.**

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Manitoba Education, Training and Youth,
Assessment and Evaluation Branch,
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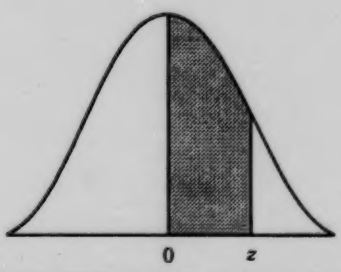
z-Score Chart



Notes:

1. For values of z above 3.09, use 0.4999 for the area.
2. Use these common values that result from interpolation:

z-score	area
1.645	0.4500
2.575	0.4950

The Standard Normal (z) Distribution

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990

Formula Sheet

Vectors

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\sin x = \frac{o}{h} \quad \cos x = \frac{a}{h} \quad \tan x = \frac{o}{a}$$

$$a^2 + b^2 = c^2$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$b^2 = a^2 + c^2 - 2ac\cos B$$

$$c^2 = a^2 + b^2 - 2ab\cos C$$

Personal Finance

$$I = PRT$$

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

$$A = P(1+i)^n$$

$$\text{mill rate} = \frac{\text{total taxes to be raised}}{\text{total assessed value}} \times 1000$$

Probability

$$P(A') = 1 - P(A)$$

$$P\ (\text{success}) = \frac{\text{number of successes}}{\text{number of outcomes}}$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$P(A \text{ and } B) = P(A) \times P(B)$$

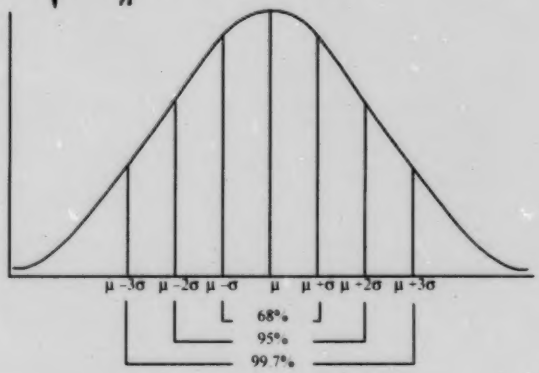
$${}_nP_r = \frac{n!}{(n-r)!}$$

$${}_nC_r = \frac{n!}{r!(n-r)!}$$

Variability and Statistics

$$z = \frac{x - \bar{x}}{\sigma} \qquad \bar{x} = \frac{\sum x}{n} \text{ or } \bar{x} = np$$

$$\sigma = \sqrt{\frac{\sum (x-\mu)^2}{n}} \qquad \sigma = \sqrt{npq} \qquad \mu = np$$



Design and Measurement

Rectangle: Area $= \ell \times w$

Circle: Area $= \pi r^2$ Circumference $= 2\pi r$

Triangle: Area $= \frac{bh}{2}$

or $\sqrt{s(s-a)(s-b)(s-c)}$, where $s = \frac{a+b+c}{2}$

Trapezoid: Area $= \left(\frac{b_1 + b_2}{2}\right)h$

Prism: Surface area $= Ph + 2B$

Volume $= B \times h$

Pyramid: Volume $= \frac{B \times h}{3}$

Sphere: Volume $= \frac{4}{3}\pi r^3$ Surface area $= 4\pi r^2$

Cylinder: Volume $= \pi r^2 h$ Surface area $= 2\pi rh + 2\pi r^2$

Periodic Functions

$$\text{Period} = \frac{2\pi}{\text{Frequency}} \text{ or } \frac{2\pi}{b}$$

$$y = a\sin(bx - c) + d$$

$$y = a\cos(bx - c) + d$$

SECTION A: MULTIPLE-CHOICE

Value: 10 marks **Suggested Time: 20 minutes**

1. The cell M_{13} in the matrix $M = \begin{bmatrix} 5 & 1 & 2 \\ -5 & 13 & 4 \\ -3 & -2 & -4 \end{bmatrix}$ contains the number:

A) -3 B) -2 C) 2 D) 13

2. The matrix S represents the stock of 2 items in two stores. Matrix O represents the order that each store has placed for these items. Matrices S and O are shown below.

Stocks

	Item 1	Item 2
Store A	8	15
Store B	20	17

Orders

	Item 1	Item 2
Store A	2	1
Store B	12	0

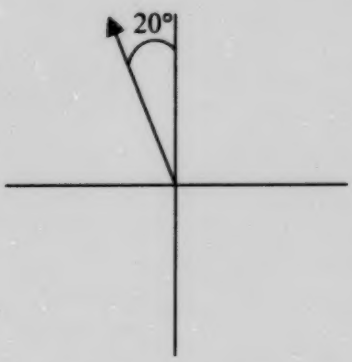
When the stores receive their shipments, their stock can now be represented by the matrix:

A) $\begin{bmatrix} 6 & 14 \\ 8 & 17 \end{bmatrix}$ B) $\begin{bmatrix} 196 & 8 \\ 244 & 20 \end{bmatrix}$

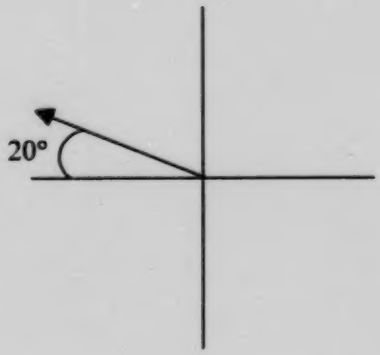
C) $\begin{bmatrix} 36 & 47 \\ 96 & 180 \end{bmatrix}$ D) $\begin{bmatrix} 10 & 16 \\ 32 & 17 \end{bmatrix}$

3. A cyclist is travelling at a bearing of 340°. Which of the following vectors best represents this situation?

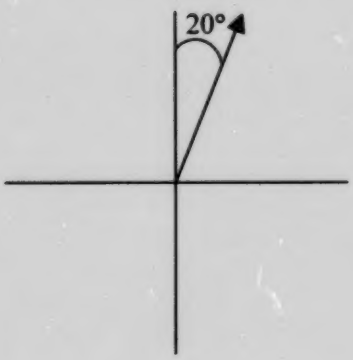
A)



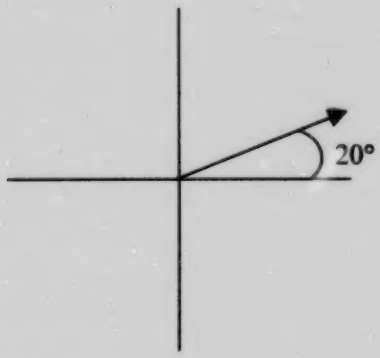
B)



C)



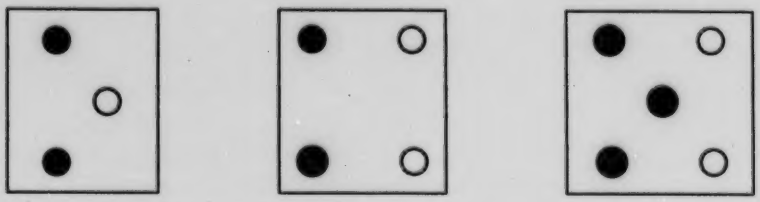
D)



4. Troy has forgotten his password to log on to his computer. He knows the password is made up of the 5 letters in the word "SPEED". What is the maximum number of passwords Troy has to check to find the right one?

A) 24 B) 60 C) 120 D) 240

5. The three boxes illustrated below contain black marbles and white marbles.



If Marcelle picks at random one marble from each box, what is the probability of picking exactly three black marbles?

A) $\frac{1}{15}$ B) $\frac{1}{5}$ C) $\frac{7}{12}$ D) $\frac{14}{15}$

6. The results of a test are normally distributed with a mean of 77.6 and a standard deviation of 4. Determine Jennifer's z-score if her test mark is 78.

A) 1.6 B) 0.4 C) 0.1 D) –0.1

7. Determine the **population** standard deviation for the following set of data:

5 7 9 6 7 15 3

A) 3.54 B) 3.82 C) 7.00 D) 7.43

8. For a location where the average yearly temperature is 22°C, which of the following sinusoidal equations represents the average monthly temperature?

A) $y = 1.5\sin(x - 22) + 7$ B) $y = 7\sin(0.5x - 2) + 22$

C) $y = 22\sin(2x + 1) + 3$ D) $y = 2\sin(22x - 7) + 1$

9. Biologically, each person's ancestors include two parents, four grandparents and so on. Your parents are considered to be the first generation of ancestors. How many ancestors are there in the 5^{th} generation?

A) 10 B) 16 C) 32 D) 64

10. Brent invests $20 000 compounded annually at 9%. Each year, he withdraws $1000 from the account after the annual interest has been added.

What is the balance at the end of the 3^{rd} year after Brent has withdrawn the $1000?

A) $22 400.00 B) $22 622.48 C) $22 900.58 D) $23 622.48

SECTION B: CONSTRUCTED-RESPONSE

(Value: 51 marks) **(Suggested Time: 130 minutes)**

DIRECTIONS

- There are 15 constructed-response questions in this section of the test. Each question is worth 2 to 6 marks.
- Provide **complete answers** in the spaces provided in the test booklet. You may print out sketches from the computer or your calculator where applicable. Make sure these pages are stapled in the booklet where the question begins and that they contain the booklet ID number.
- Provide clear explanations or justifications where applicable. This could be done through labelled diagrams, in words, by showing mathematical operations to verify your answer or by referencing a software or a calculator program.
- Let the mark values for each question guide your time and the amount of detail you use in your answer. Mark values for subsections of a question are indicated beside each section in parentheses.
- Round your final answers to the nearest two decimal places.
- Unless otherwise specified, it is not necessary to draw sketches to scale. If you draw a scale diagram, make sure you indicate your scale.
- An answer without any work shown may be considered incomplete.

DO NOT USE

101

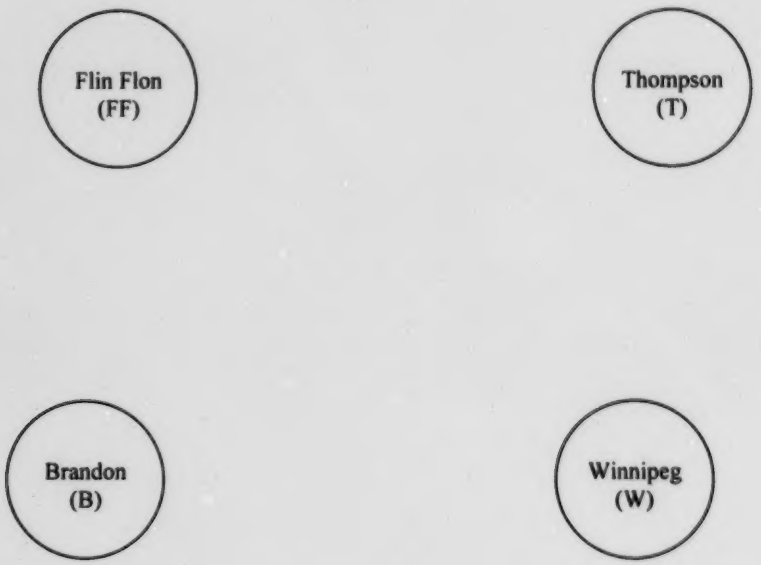
11. An airline company offers daily flights among Brandon, Flin Flon, Thompson and Winnipeg. The number of daily direct flights is as follows:

Total: 5 marks

- From Winnipeg, there are two flights to Thompson, one flight to Brandon and one flight to Flin Flon.
- From Brandon, there are two flights to Winnipeg.
- From Thompson, there is one flight to Winnipeg and one flight to Flin Flon.
- From Flin Flon, there are two flights to Winnipeg and one flight to Thompson.

a) Using all the information provided above, create a direct route map of the daily flights between these cities.

(1 mark)



DO NOT USE

b) Complete matrix R as shown below, to indicate the number of routes between cities.

(1 mark)

$$\text{From: } R = \begin{array}{c} \\ W \\ B \\ FF \\ T \end{array} \begin{array}{c} \begin{array}{cccc} \text{To:} & & & \\ W & B & FF & T \end{array} \\ \begin{bmatrix} & & & \\ & & & \\ & & & \\ & & & \end{bmatrix} \end{array}$$

c) Indicate matrix operations that show the number of ways that a plane can go between any two cities, either directly or through at most one other city.

(1 mark)

d) The airline would like to eliminate four flights from its schedule. All destinations should still be reached either directly or at most through one other city.

Make a recommendation as to which four flights should be eliminated. Show that all destinations can still be reached.

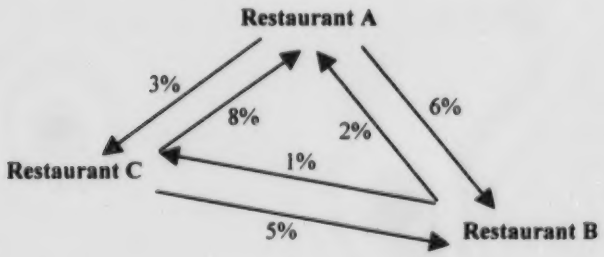
(2 marks)

DO NOT USE

12. The following diagram shows the percentage of people who change their preference for a favourite restaurant from one month to the next.

Total: 4 marks

102



a) Create a transition matrix T that indicates the changes. Clearly label your matrix.

(2 marks)

b) Presently there are 200 people who prefer Restaurant A, 150 who prefer Restaurant B, and 350 who prefer Restaurant C.

Using matrices, state the number of people who will prefer each restaurant next month. Show the matrices used. Clearly label your final answer.

(2 marks)

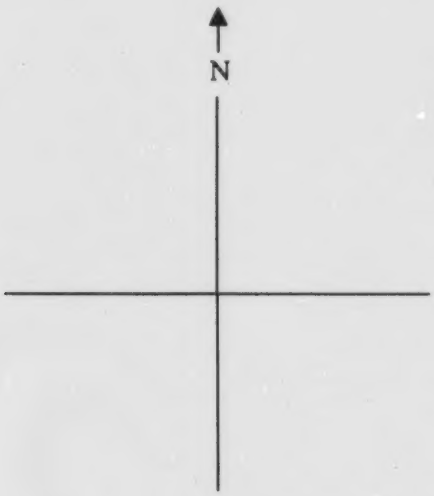
DO NOT USE

13. A ship heads NW at a speed of 25 knots. The ship is pushed by a current moving from the west at 10 knots.

Total: 3 marks

Sketch a vector diagram of this situation. Calculate the ship's resultant direction. Support your answer.

103

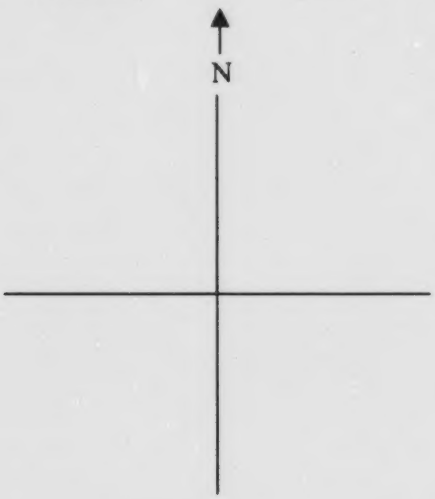


14. Using a scale of 1 cm = 15 km/hr, draw a vector representing the following:

104

Total: 2 marks

50 km/hr S 35° W



DO NOT USE

15. Carmella leaves home and walks north for 4.8 km, then west for 3.6 km and arrives at school.

Total: 6 marks

a)
- Sketch a vector diagram of this situation.
- What is the shortest distance between Carmella's school and her home?
- What direction must she take to follow this path home?

(3 marks)

105

b) Design another route for Carmella to return home from school assuming she must begin walking in a direction S 20° W.

(3 marks)

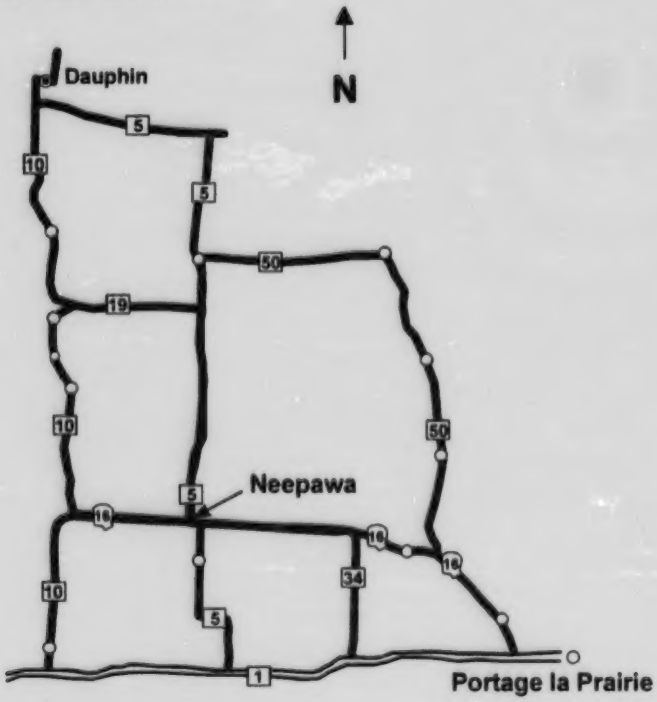
Sketch a route she could take and indicate all distances and directions.

DO NOT USE

106

16. Consider the map shown below.

Total: 3 marks



a) Calculate how many different ways Erin can drive from Portage la Prairie to Dauphin if she drives in the general direction north or west. Show how you arrived at your answer.

(2 marks)

b) What is the probability of Erin **not** passing through Neepawa?

(1 mark)

DO NOT USE

17. Santos, Ray and Aniko each shoot an arrow at a target once. The probabilities that they each hit the target are 0.1, 0.2 and 0.3 respectively.

Total: 4 marks

a) What is the probability that all three will **miss** the target? 107

(2 marks)

b) Fred wanted to calculate the probability that exactly two of the people hit the target. His calculation is shown:

$$0.1 \times 0.2 \times 0.7 = 0.014$$

Explain what is wrong with his calculation and determine the correct probability.

(2 marks)

18. From a sample of 24 students, 11 are taking Applied Mathematics, 16 students are taking Pre-Calculus Mathematics and 4 students are taking both.

Total: 2 marks

What is the probability of randomly choosing a student from the class that is neither in Applied Mathematics nor in Pre-Calculus Mathematics? Show how you arrived at your answer. 108

DO NOT USE

109

19. The Royal Canadian Mint recently sampled the masses of their dimes and pennies to determine how accurately they were being produced. The masses were normally distributed.

Total: 4 marks

a) The following table gives the frequencies of the pennies. Determine the mean and the **population** standard deviation of the data. Round your answer to 2 decimal places.

(2 marks)

Mass (g)	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4
Frequency	2	15	57	120	138	109	54	14

b) Dimes are known to have a mean of 1.6 grams and a standard deviation of 0.11. Determine the z-score of a dime with a mass of 1.3 grams. Round your answer to 2 decimal places.

(1 mark)

c) Explain how likely it is to produce a dime with a mass of 1.3 grams or less. Support your answer.

(1 mark)

DO NOT USE

110

20. It is found that 40% of all students returning to school in September catch a common cold, while the rest do not. From among the students in a school, 600 students are randomly selected.

Total: 4 marks

a) Determine the mean and the **population** standard deviation for the students who catch a cold.

(2 marks)

b) What is the 90% confidence interval for the mean number of students who will catch a cold in this group? Explain the meaning of your confidence interval.

(2 marks)

DO NOT USE

111

21. The number of people employed by a restaurant is modelled by the function (expressed in radians):

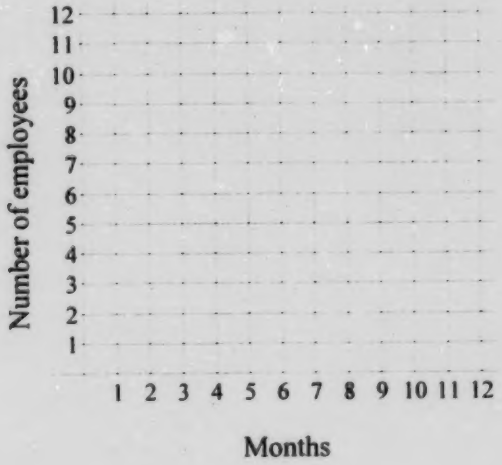
Total: 2 marks

$$y = 3\sin(0.52x + 1) + 7.2$$

where x represents the month and y represents the number of people employed (assume January = month 1)

a) Sketch a graph for this function for one year.

(1 mark)



b) What is the maximum number of people employed?

(1 mark)

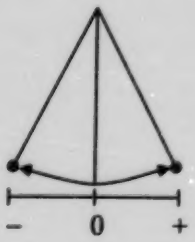
DO NOT USE

112

22. A pendulum is observed and data is collected as shown below. When the pendulum is to the right of its resting place, a positive distance is recorded. A negative distance indicates the pendulum is to the left of its resting place.

Total: 2 marks

Time (sec.)	Distance (cm)
1.70	1.81
2.98	6.76
3.49	–7.89
4.77	–0.52
5.85	12.67



a) Write an equation to represent the sinusoidal motion of the pendulum.

(1 mark)

b) What is the position of the pendulum when $t = 5$ seconds?

(1 mark)

DO NOT USE

113

23. The Great Canadian Bungee Company offers jumps from a 200-ft bridge. A jumper's height above the water for the first 10 seconds is modelled by:

Total: 3 marks

$$y = 98\sin(0.63x + 1.5) + 102$$

where y is the height in feet and x is the time in seconds.

a) Determine the period and the amplitude.

(2 marks)

b) Describe what the period represents in this situation.

(1 mark)

DO NOT USE

24. Scientists have determined that 8 parts per million (ppm) of oil in water is an acceptable level. After an oil spill, the level of oil in a spill zone rises to 900 ppm. It is known that each week the spilled oil is reduced by 40%.

Total: 5 marks

114

a) How many weeks will it take for the oil to be at an acceptable level? Explain how you arrived at your answer.

(2 marks)

b) Chemicals could be added to the spill zone at the beginning of each week to speed up the process. There are two treatments available:

(3 marks)

Treatment 1: oil is reduced by an additional 50 ppm at a cost $1 million per treatment

Treatment 2: oil is reduced by an additional 10 ppm at a cost $550 000 per treatment

Compare treatment 1 and 2 in order to recommend a treatment, if any.
Analyze the cost and time requirements for each treatment.
Support your answer by providing cost and time involved.

DO NOT USE

25. A sequence of inscribed squares is formed by joining the midpoints of the previous square. Each side of the original square is 512 cm long.

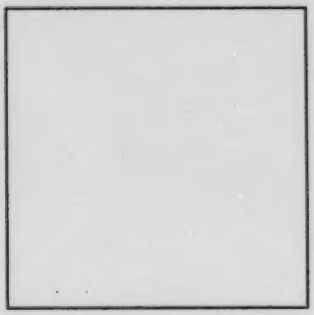
Total: 2 marks

115

a) Continue the pattern for 1 more generation.

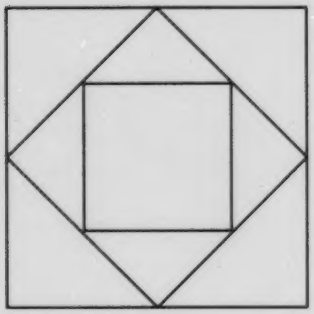
(1 mark)

Original

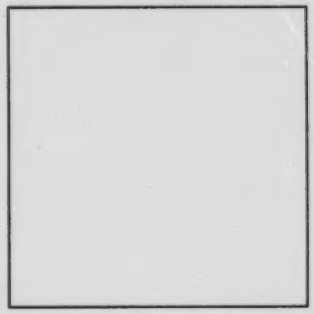


1st generation

2nd generation



3rd generation



b) Determine the area of the new square in the 3rd generation.

(1 mark)

END OF TEST

NO MARKS WILL BE AWARDED FOR WORK DONE ON THIS PAGE

NO MARKS WILL BE AWARDED FOR WORK DONE ON THIS PAGE

NO MARKS WILL BE AWARDED FOR WORK DONE ON THIS PAGE

11692

Senior 4 Applied Mathematics (40S)

Standards Test

Inquiry Task

January 2002

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Education,
Training
and Youth

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Formula Sheet

Vectors

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\sin x = \frac{o}{h} \quad \cos x = \frac{a}{h} \quad \tan x = \frac{o}{a}$$

$$a^2 + b^2 = c^2$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$b^2 = a^2 + c^2 - 2ac\cos B$$

$$c^2 = a^2 + b^2 - 2ab\cos C$$

Personal Finance

$$I = PRT$$

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

$$A = P(1+i)^n$$

$$\text{mill rate} = \frac{\text{total taxes to be raised}}{\text{total assessed value}} \times 1000$$

Probability

$$P(A') = 1 - P(A)$$

$$P\ (\text{success}) = \frac{\text{number of successes}}{\text{number of outcomes}}$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$P(A \text{ and } B) = P(A) \times P(B)$$

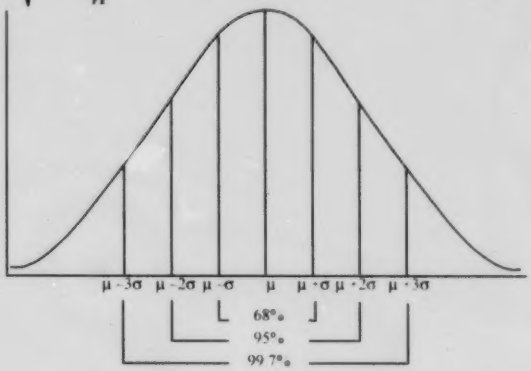
$${}_nP_r = \frac{n!}{(n-r)!}$$

$${}_nC_r = \frac{n!}{r!(n-r)!}$$

Variability and Statistics

$$z = \frac{x - \bar{x}}{\sigma} \qquad \bar{x} = \frac{\sum x}{n} \text{ or } \bar{x} = np$$

$$\sigma = \sqrt{\frac{\sum (x-\mu)^2}{n}} \qquad \sigma = \sqrt{npq} \qquad \mu = np$$



Design and Measurement

Rectangle: Area $= \ell \times w$

Circle: Area $= \pi r^2$ Circumference $= 2\pi r$

Triangle: Area $= \frac{bh}{2}$

or $\sqrt{s(s-a)(s-b)(s-c)}$, where $s = \frac{a+b+c}{2}$

Trapezoid: Area $= \left(\frac{b_1 + b_2}{2}\right)h$

Prism: Surface area $= Ph + 2B$

Volume $= B \times h$

Pyramid: Volume $= \frac{B \times h}{3}$

Sphere: Volume $= \frac{4}{3}\pi r^3$ Surface area $= 4\pi r^2$

Cylinder: Volume $= \pi r^2 h$ Surface area $= 2\pi rh + 2\pi r^2$

Periodic Functions

$$\text{Period} = \frac{2\pi}{\text{Frequency}} \text{ or } \frac{2\pi}{b}$$

$$y = a\sin(bx - c) + d$$

$$y = a\cos(bx - c) + d$$

SENIOR 4 APPLIED MATHEMATICS (40S)
STANDARDS TEST

DESCRIPTION

Total Possible Marks: 20 **Time: 1.5 hours**

This test consists of two tasks:

	Description	Suggested Time to Complete	Marks
Task 1	Contains several questions on Personal Finance unit worth a total 10 marks	45 minutes	10
Task 2	Contains several questions on Design and Measurement unit worth 10 marks	45 minutes	10

Test Resources and Directions

- This test should be written with the assistance of computer software and/or a graphing calculator.
- Students are provided with a formula sheet on a detachable sheet on page 1 of this booklet.
- If you use a graphing calculator, make sure you indicate all the values you entered in the space provided in this booklet.
- If you use computer software, make sure you print two copies of your spreadsheets, one showing the answers and one showing the formulas. Indicate your booklet ID number on each page.
- Please staple printed copies of all work done to this booklet on the page of the question. Indicate your booklet ID number on each page.
- Clearly identify the question number on your answer sheet(s) (e.g., Question 2b).

PERSONAL FINANCE

DO NOT USE

1. Maila just graduated and has decided to treat herself by getting a new car. The local dealer has a special on a new compact car with a purchase price of $17 036.00. She plans to own the car for 4 years.

Total: 10 marks

Option 1 – Lease the car

Down Payment:	$2785.00
Monthly Lease Payment:	$199.00 (taxes included) for 48 months
Purchase Price Option at end of Lease:	$7740.00

Since she only wants the car for 4 years, under this option she would not exercise her option to purchase the car and would return it to the dealer.

a) Calculate the total cost of leasing the car for the 4 years. 116

(1 mark)

Option 2 – Purchase the car

Purchase Price:	$17 036.00	(plus PST and GST)
Down Payment:	$2785.00	
Finance Rate:	1.9% per annum, compounded monthly	

Under this option, she would sell the car after 4 years. She assumes that she will be able to sell it for the lease return price of $7740.00.

b) Calculate the total cost of purchasing the car and selling it after 4 years for $7740.00. 117

(5 marks)

TVM solver values: N = _____ (or print your spreadsheet)

I% = _____

PV = _____

PMT = _____

FV = _____

P/Y = _____

C/Y = _____

PMT = _____

b) Response (*continued*):

DO NOT USE

c) Give two reasons why a person might lease a car rather than buy it.

(2 marks) 118

d) If a car is worth $7740 and depreciates 6% a year, what will the car be worth after 3 years? Indicate how you arrived at your answer.

(2 marks) 119

DESIGN AND MEASUREMENT

DO NOT USE

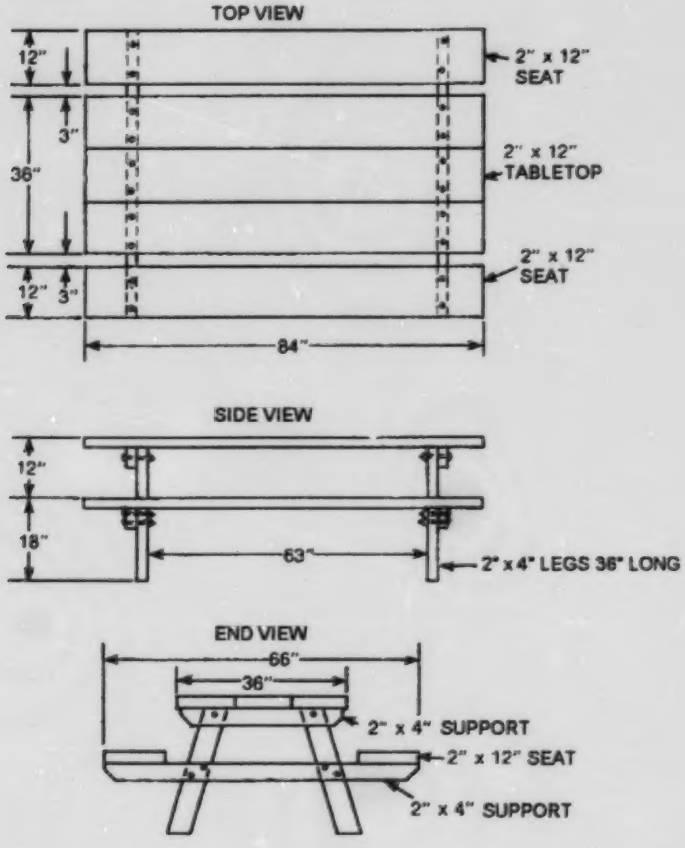
2. A picnic table forms the center of activity for most outdoor gatherings, and the traditional picnic table shown here is big enough to comfortably seat a large group for an outdoor get-together. Since you have decided to build one, it is necessary for you to determine the amount of material necessary to accomplish the task.

Total: 10 marks

120

The picnic table as illustrated will be constructed using 2 inches by 4 inches (2" × 4") and 2 inches by 12 inches (2" × 12") lumber. The lengths and prices of this lumber are found in the materials list shown on the next page. The cost of miscellaneous hardware such as nails, screws and bolts is included in this materials list as well.

Different views of the picnic table:



(Total marks: 10 marks)

DO NOT USE

Do not substitute 2" by 12" pieces with 2" by 4" pieces.
Lumber is sold in pre-cut lengths as shown below.

Materials List		
Type	**Length**	**Unit Price**
2" × 4"	8'	$2.48
2" × 4"	10'	$2.70
2" × 4"	12'	$3.24
2" × 4"	14'	$4.28
2" × 4"	16'	$4.98
2" × 12"	8'	$7.02
2" × 12"	10'	$8.78
2" × 12"	12'	$11.52
2" × 12"	14'	$17.64
2" × 12"	16'	$22.90
Miscellaneous Hardware for one table (nails, screws, bolts)		$20.00

QUESTIONS

2a) By providing a detailed cost analysis, show how you can build the table for under $85.00 including taxes. Specify how you are using the lumber for the different parts of the table. State any assumptions you have made.

(7 marks)

Organization of your work will be a factor in marking. (Space for response is provided on the next page.)

2a) Response (*continued*):

DO NOT USE

2b) Two neighbours decide to get together and build two tables. Indicate the specific materials to be purchased, and calculate the minimum cost for building the two tables.

DO NOT USE

(3 marks)

END OF TEST

Senior 4 Applied Mathematics (40S)

Standards Test

Marking Package

January 2002

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Education,
Training
and Youth

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Marking Keys and Scoring Rubrics for the Inquiry Task **41**

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B-*Generating Student Profiles* Sheet 67

General Instructions

Organization of document:

Following the general instructions for marking, the document is divided into three sections:

- Answer key for multiple-choice items
- Marking keys and scoring rubrics for constructed-response items
- Marking keys and scoring rubrics for the Inquiry Task

The first section presents the answers for the multiple-choice items in a table accompanied by the learning outcome(s) associated with each item. In the second section, each test item is presented in bold characters, followed by a series of typical and possible answers. A marking key or scoring rubric details how the marks are to be allocated for each sub-section of the question. Marking keys are used to mark restricted-response items (with or without explanations). Scoring rubrics are to be used for scoring open-response items.

For each question, the item type, the maximum number of marks possible as well as the specific outcomes targeted by the item are identified at the top of the page. Items are presented in the order that they appear on the standards test. Each open-response item as well as each Inquiry Task item is followed by a series of student exemplars collected during the pilot administration of the *Senior 4 Applied Mathematics (40S) Standards Test* in the 2000–2001 school year. Student exemplars are chosen to exemplify the use of scoring rubrics or marking keys for marking. The mark value allocated and a rationale justifying the mark allocation accompany each student exemplar.

General Marking Instructions

Please make no marks in the test booklets.

Please ensure that:

- each student's final result is recorded, by test booklet number, on the corresponding ***Answer/Scoring Sheet*** (computer scan sheet);
- the totals are written at the bottom;
- the *Answer/Scoring Sheet* is complete and correct;
- a copy has been made for school records; and
- **only a pencil is used to complete the *Answer/Scoring Sheets*, by both students and markers.**

Once marking is completed, please forward the *Answer/Scoring Sheet*s to Manitoba Education, Training and Youth (for more information see the *Administration Manual for Supervising Teachers*).

Scoring the Multiple-choice items

Please follow the answer key provided on page 5 of this document.

Types of student errors

As a guiding principle, students should only be penalized once for each error committed in the context of a test item. For example, students may choose an inappropriate but still relevant strategy for an item but carry it through correctly and arrive at an incorrect answer. In such cases, students should be penalized for having selected an inappropriate strategy for the task at hand but should be given credit for having arrived at an answer consistent with their choice of strategy.

Throughout this document, four types of errors have been identified. These are defined briefly below:

Trivial errors:
These are errors for which no marks are to be deducted. In order to be considered trivial, an error must be conceptually unrelated to the learning outcome(s) associated with the item and not lead to a mathematically incorrect answer. Examples include omitting labels, omitting to carry a negative sign in an algebraic task or not rounding final answers.

Technical communication errors:
These are errors of mathematical notation that are conceptually related to the curriculum outcomes. It is important to note, however, that such errors do not prevent students from arriving at a mathematically correct answer. Examples include omitting to use brackets on matrices, vector heads on vector diagrams, etc. In such cases, students are to be penalized half a mark.

Minor errors:
These are errors that are generally not conceptual in nature but will inevitably lead to an incorrect answer. In such cases, students are generally penalized one mark depending on the details provided in the marking key or scoring rubric.

Major errors:
These are errors or omissions that are conceptual in nature and clearly reflect a gap in the student's knowledge of the specific learning outcome(s). These types of errors often limit the number of marks that can be awarded to a student's response.

Scoring the Constructed-response items

The respective marking key or scoring rubric should be used in conjunction with the ***Senior 4 Mathematics: Manitoba Curriculum Framework of Outcomes and Senior 4 Standards*** (Applied section) when assigning scores to student responses.

Scoring Guidelines—Restricted-response items (with or without explanation)

Each item of this type is designed to elicit a well-defined response according to the associated specific outcome(s) and relevant mathematical processes. Their purpose is to determine whether a student meets the standards for the course (level 2) as they relate to the knowledge and skills associated with the item.

To receive full marks, a student's response must be complete and correct. Partial marks may be awarded for a "relevant strategy" with execution errors. **A relevant strategy is defined as one that is consistent with the specific outcome(s) and mathematical processes associated with the item that, if properly executed, would lead to the correct answer.** Where alternative strategies are possible, the marking key makes mention of them.

It is important to note that some items require some form of explanation or justification from students. Such explanations and justifications can take various forms depending on students' learning styles. Therefore, marking of student responses needs to reflect appropriate flexibility in this regard. Test instructions to students have clearly specified that explanations or justifications can be done through labeled diagrams, in words, by showing mathematical operations for answer verification or by referencing software or a calculator program.

Scoring Guidelines—Open-response items

These items are designed to elicit student responses at any of the three levels of achievement defined in the *Senior 4 Mathematics: Manitoba Curriculum Framework of Outcomes and Senior 4 Standards* (Applied section). The rubrics contain the language of

the curricular standards in order to facilitate scoring in a manner that is consistent with those standards. The recommended procedure for scoring student responses is as follows:

1. Read the relevant specific outcome(s) in the *Senior 4 Mathematics: Manitoba Curriculum Framework of Outcomes and Senior 4 Standards* (Applied section).
2. Read the possible solution(s) provided in this document.
3. Study the student exemplars provided and the rationales for the assigned scores.
4. Carefully view all of the student's response and decide which of the three levels of achievement ("exceptional understanding", "good understanding" or "limited understanding") best applies. Whether the response clearly fits into one category or straddles two, this process will narrow down the number of possible scores that can be assigned to the response.
5. Compare the features of the student's response with the general performance indicators accompanying the mark values and the specific performance indicators (criteria) contained in the rubric. Note that the specific performance indicators only typify a student's response in a given score category. An exact match is not anticipated.

Assistance

If, during marking, any issue arises that cannot be resolved locally, please call Manitoba Education, Training and Youth at the earliest opportunity to advise and/or seek assistance. If required, we will connect you to an advisor. Also, please be sure to notify us before making any modifications to the answer/marking keys or scoring rubrics.

Contact person: Marie-Josée Gendron at 945-5136 (1 800 282-8069, extension 5136).

Answer Key
for Multiple-choice items

Question No.	Answer	Outcome
1	C	A1
2	D	A1
3	A	B1
4	B	D2
5	B	D5
6	C	E2
7	A	E1
8	B	G1
9	C	H1
10	B	H1

Marking Keys and Scoring Rubrics for Constructed-response items

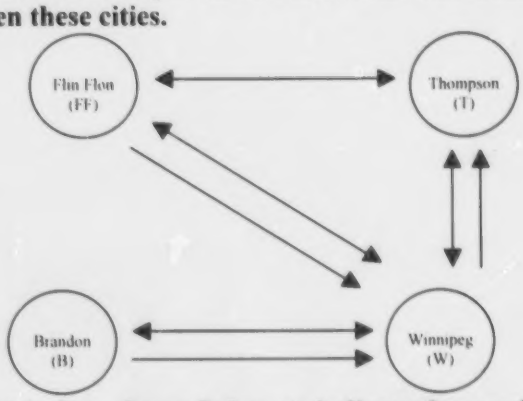
Specific Outcomes: A2 **Item Type: Open Response**

Question No. 11 and Answer (5 marks)

An airline company offers daily flights among Brandon, Flin Flon, Thompson and Winnipeg. The number of daily direct flights is as follows:

- **From Winnipeg, there are two flights to Thompson, one flight to Brandon and one flight to Flin Flon.**
- **From Brandon, there are two flights to Winnipeg.**
- **From Thompson, there is one flight to Winnipeg and one flight to Flin Flon.**
- **From Flin Flon, there are two flights to Winnipeg and one flight to Thompson.**

a) Using all the information provided above, create a direct route map of the daily flights between these cities.



b) Complete matrix R as shown below, to indicate the number of routes between cities.

To:

From:		W	B	FF	T
	W	0	1	1	2
	B	2	0	0	0
$R =$	FF	2	0	0	1
	T	1	0	1	0

c) Indicate matrix operations that show the number of ways that a plane can go between any two cities, either directly or through at most one other city.

To:

From: $R + R^2 =$	W	B	FF	T
W	6	1	3	3
B	2	2	2	4
FF	3	2	3	5
T	3	1	2	3

d) The airline would like to eliminate four flights from its schedule. All destinations should still be reached either directly or at most through one other city.

Make a recommendation as to which four flights should be eliminated. Show that all destinations can still be reached.

Eliminate the three duplicate flights (Winnipeg to Thompson, Brandon to Winnipeg, Flin Flon to Winnipeg) and eliminate either Flin Flon to Thompson or Thompson to Flin Flon.*

To:

From: $R =$	W	B	FF	T
W	0	1	1	1
B	1	0	0	0
FF	1	0	0	0
T	1	0	1	0

To:

From: $R + R^2 =$	W	B	FF	T
W	3	1	2	1
B	1	1	1	1
FF	1	1	1	1
T	2	1	2	1

OR

Three duplicate flights can be eliminated because they already have one flight to that destination. Flin Flon to Thompson (or Thompson to Flin Flon) can be eliminated because that destination can be reached by flying through one other city (Winnipeg).*

Scoring Rubric

	Score and General Performance Indicators	Specific Performance Indicators/Criteria
Level 1 limited understanding	**1** **weak attempt, inappropriate strategy or no strategy**	- 1 criterion correct
	2 **reasonable attempt, appropriate strategy with major errors or omissions**	- 2 criteria correct
Level 2 good understanding	**3** **reasonable strategy, minor errors and/or omissions**	- 3 criteria correct
	4 **sound strategy, mostly complete, minor errors**	- 4 criteria correct
Level 3 exceptional understanding	**5** **complete and correct, reflecting exceptional understanding**	- 5 criteria correct

Criteria:

1) 1 mark for the correct answer in a)
2) 1 mark for the correct answer in b)
3) 1 mark for the correct answer in c)
4) 1 mark for an appropriate recommendation in d)
5) 1 mark for appropriate support given in d)

Marker Notes:

- *If student makes an error in any one part and is consistent with his/her error - only penalize once.*
- **Solutions other than the ones presented here are possible in part d).*
- *The student must be specific about how to get from one city to the other through one other city in d) either by a written explanation, an updated diagram or a route matrix.*

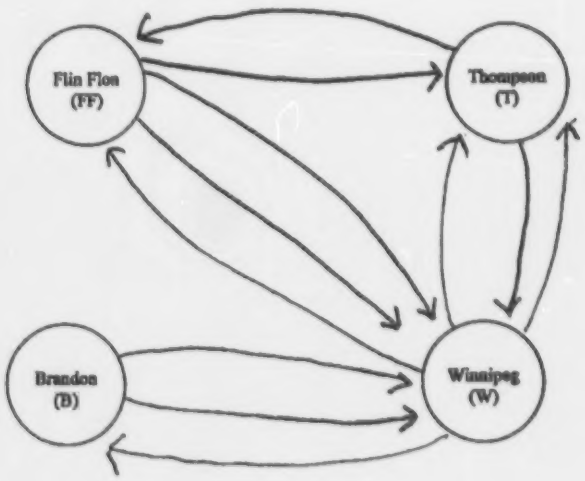
Student exemplar 1

Total: 5 marks

An airline company offers daily flights among Brandon, Flin Flon, Thompson and Winnipeg. The number of daily direct flights is as follows:

- From Winnipeg, there are two flights to Thompson, one flight to Brandon and one flight to Flin Flon.
- From Brandon, there are two flights to Winnipeg.
- From Thompson, there is one flight to Winnipeg and one flight to Flin Flon.
- From Flin Flon, there are two flights to Winnipeg and one flight to Thompson.

a) Using all the information provided above, create a direct route map of the daily flights between these cities.



b) Complete matrix R as shown below, to indicate the number of routes between cities.

To:

From: $R =$

	W	B	FF	T
W	0	1	1	2
B	2	0	0	0
FF	2	0	0	1
T	1	0	1	0

c) Indicate matrix operations that show the number of ways that a plane can go between any two cities, either directly or through at most one other city.

$2R$

d) The airline would like to eliminate four flights from its schedule. All destinations should still be reached either directly or at most through one other city.

Make a recommendation as to which four flights should be eliminated. Show that all destinations can still be reached.

$R_{14} - 1$ $\quad R_{21} - 1$

R_{13} $\quad R_{31} - 1$

2 marks:

- Correctly creates route map and matrix showing routes
- Unable to solve problems using matrix operations in c)
- Invalid recommendation with no support in d)

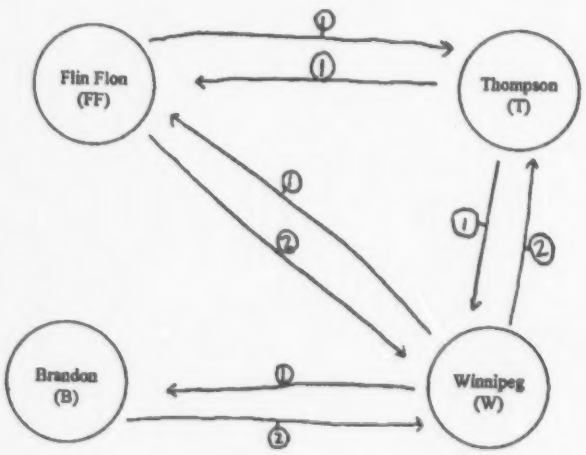
Student exemplar 2

Total: 5 marks

An airline company offers daily flights among Brandon, Flin Flon, Thompson and Winnipeg. The number of daily direct flights is as follows:

- From Winnipeg, there are two flights to Thompson, one flight to Brandon and one flight to Flin Flon.
- From Brandon, there are two flights to Winnipeg.
- From Thompson, there is one flight to Winnipeg and one flight to Flin Flon.
- From Flin Flon, there are two flights to Winnipeg and one flight to Thompson.

a) Using all the information provided above, create a direct route map of the daily flights between these cities.



b) Complete matrix R as shown below, to indicate the number of routes between cities.

To:

From: $R =$

	W	B	FF	T
W	0	1	1	2
B	2	0	0	0
FF	2	0	0	1
T	1	0	1	0

c) Indicate matrix operations that show the number of ways that a plane can go between any two cities, either directly or through at most one other city.

you could go from winnipeg to flin flon, and end up in Thompson.

d) The airline would like to eliminate four flights from its schedule. All destinations should still be reached either directly or at most through one other city.

Make a recommendation as to which four flights should be eliminated. Show that all destinations can still be reached.

- Take off one flight from Flin flon to winipeg (back to 1 flight a day)
- Take off one flight from winnipeg to Thompson "
- Take off one flight from Brandon to winnipeg "
- Take off one flight from Thompson to flinflon

I would take off the thompson to flin flon because you can still get to flin flon by going through winnipeg.

4 marks:
- Correctly creates route map and matrix showing routes
- Valid recommendation with reasonable support in d)
- Unable to solve problems using matrix operations in c)

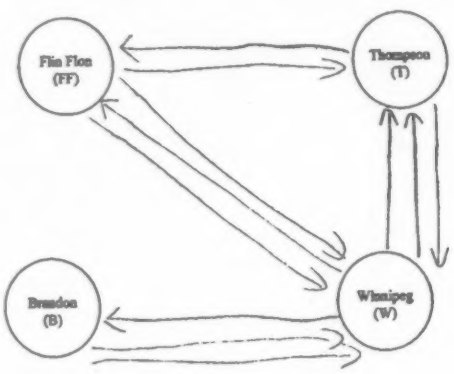
Student exemplar 3

Total: 5 marks

An airline company offers daily flights among Brandon, Flin Flon, Thompson and Winnipeg. The number of daily direct flights is as follows:

- From Winnipeg, there are two flights to Thompson, one flight to Brandon and one flight to Flin Flon.
- From Brandon, there are two flights to Winnipeg.
- From Thompson, there is one flight to Winnipeg and one flight to Flin Flon.
- From Flin Flon, there are two flights to Winnipeg and one flight to Thompson.

a) Using all the information provided above, create a direct route map of the daily flights between these cities.



b) Complete matrix R as shown below, to indicate the number of routes between cities.

To:

From: $R =$

	W	B	FF	T
W	0	1	1	2
B	2	0	0	0
FF	2	0	0	1
T	1	0	1	0

c) Indicate matrix operations that show the number of ways that a plane can go between any two cities, either directly or through at most one other city.

$$R + R^2 = \begin{bmatrix} 6 & 1 & 3 & 3 \\ 2 & 2 & 2 & 4 \\ 3 & 2 & 3 & 5 \\ 3 & 1 & 2 & 3 \end{bmatrix}$$

d) The airline would like to eliminate four flights from its schedule. All destinations should still be reached either directly or at most through one other city.

Make a recommendation as to which four flights should be eliminated. Show that all destinations can still be reached.

Cut flights

1. one FlinFlon to Winnipeg
2. one Brandon to Winnipeg
3. one Winnipeg to Thompson
4. Thompson to Flin Flon

New Matrix $R = \begin{bmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \end{bmatrix}$

$R + R^2 = \begin{bmatrix} 3 & 1 & 2 \\ 1 & 1 & 1 \\ 2 & 1 & 2 \\ 1 & 1 & 1 \end{bmatrix}$

With those cuts, possible to get everywhere directly or through one other place.

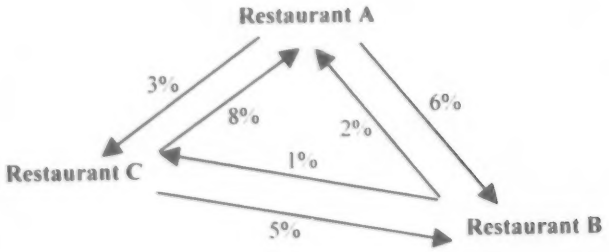
5 marks:

- Correctly creates route map and matrices
- Correct numbers and operation of matrices to solve problem
- Valid recommendation with thorough support
- No marks deducted for unlabelled matrix in c) and d)

Specific Outcomes: A2 **Item Type: Restricted Response with Explanation**

Question No. 12 and Answer (4 marks)

The following diagram shows the percentage of people who change their preference for a favourite restaurant from one month to the next.



a) **Create a transition matrix T that indicates the changes. Clearly label your matrix.**

$$T = \begin{array}{c} \\ \text{A} \\ \text{B} \\ \text{C} \end{array} \begin{array}{c} \begin{array}{ccc} \text{A} & \text{B} & \text{C} \end{array} \\ \begin{bmatrix} 0.91 & 0.06 & 0.03 \\ 0.02 & 0.97 & 0.01 \\ 0.08 & 0.05 & 0.87 \end{bmatrix} \end{array}$$

b) **Presently there are 200 people who prefer Restaurant A, 150 who prefer Restaurant B, and 350 who prefer Restaurant C.**

Using matrices, state the number of people who will prefer each restaurant next month. Show the matrices used. Clearly label your final answer.

$$\begin{array}{ccc} \text{A} & \text{B} & \text{C} \end{array} \begin{bmatrix} 200 & 150 & 350 \end{bmatrix} \begin{array}{c} \begin{array}{ccc} \text{A} & \text{B} & \text{C} \end{array} \\ \begin{bmatrix} 0.91 & 0.06 & 0.03 \\ 0.02 & 0.97 & 0.01 \\ 0.08 & 0.05 & 0.87 \end{bmatrix} \end{array} = \begin{array}{c} \begin{array}{ccc} \text{A} & \text{B} & \text{C} \end{array} \\ \begin{bmatrix} 213 & 175 & 312 \end{bmatrix} \end{array}$$

OR

$$P = \begin{array}{c} \begin{array}{ccc} \text{A} & \text{B} & \text{C} \end{array} \\ \begin{bmatrix} 200 & 150 & 350 \end{bmatrix} \end{array}$$

$$P * T = \begin{array}{c} \begin{array}{ccc} \text{A} & \text{B} & \text{C} \end{array} \\ \begin{bmatrix} 213 & 175 & 312 \end{bmatrix} \end{array}$$

Marker Notes:

- *Do not deduct marks if the matrix is not labelled*

Marking Key
1 mark for the correct diagonal values (e.g. transition matrix or transition diagram)
1 mark for the correct answer in a) (i.e. remaining numbers in matrix)
1 mark for an appropriate strategy (i.e. multiply transition by original matrix) in b)
1 mark for the correct answer in b)

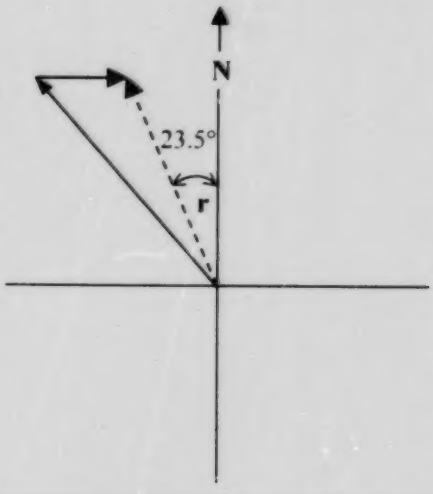
Specific Outcomes: B1, B3 | **Item Type: Restricted Response**

Question No. 13 and Answer (3 marks)

A ship heads NW at a speed of 25 knots. The ship is pushed by a current moving from the west at 10 knots.

Sketch a vector diagram of this situation. Calculate the ship's resultant direction. Support your answer.

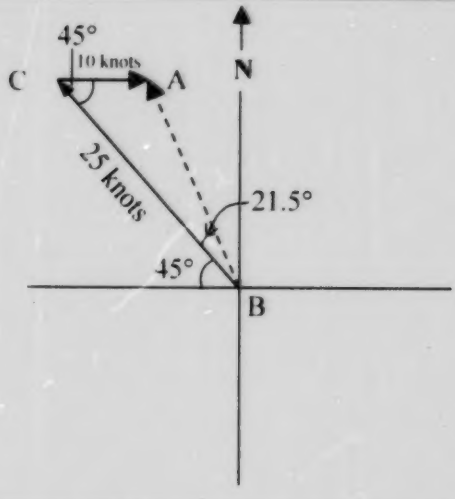
Scale: 1 cm = 5 knots
Speed: r = 3.86 cm × 5 = 19.3 knots
Direction: N 23.5° W



OR

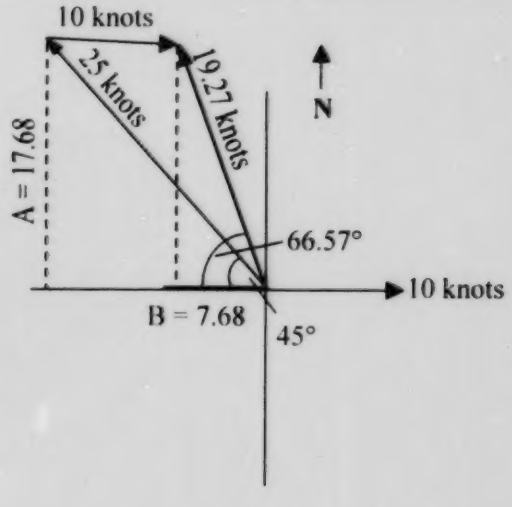
TriSolve:

Input	Output
a = 25 knots	c = 19.3 knots
b = 10 knots ⇒	A = 113.5°
C = 45°	B = 21.5°



Resultant speed: 19.3 knots
Resultant direction: N 23.5° W
or 23.5° W of N or W 66.5° N
or 66.5° N of W or bearing: 336.5°

OR



A = 17.68
B = 17.68 − 10 = 7.68

$$\text{Direction} = \tan\theta = \frac{17.68}{7.68} = 66.57°$$

W 66.57° N

Marking Key
1 mark for an appropriate strategy or correct answer
1 mark for the correct answer for direction
1 mark for the correct vector diagram

Specific Outcomes: B1 **Item Type: Restricted Response**

Question No. 14 and Answer (2 marks)

Using a scale of 1 cm = 15 km/hr, draw a vector representing the following:

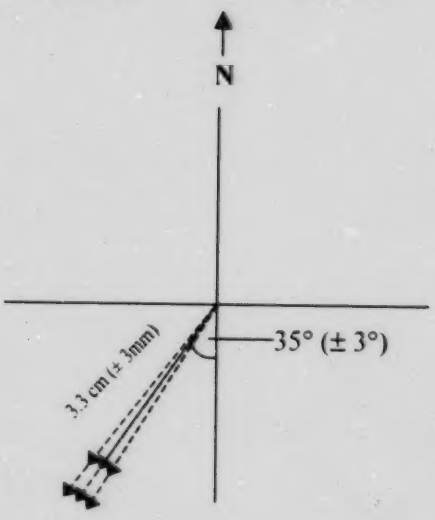
50 km/hr **S 35° W**

$\frac{1}{x}\text{ cm} = \frac{15}{50}\text{ km/hr}$

$x = 3.33\text{ cm}$

or

$\frac{50}{15}\text{ km/hr} = 3.33\text{ cm}$



Marker Notes:

- *A transparency of this sheet would facilitate marking.*
- *A sketch with the correct numbers indicated that is not drawn to scale - award 1 mark.*

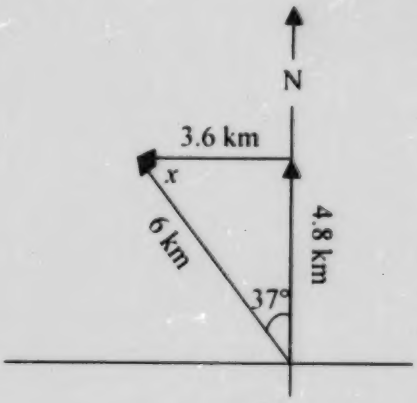
Marking Key
1 mark for the correct distance (± 3 mm)
1 mark for the correct direction (± 3°)

Specific Outcomes: B1, B2, B3 **Item Type: Open Response**

Question No. 15 and Answer (6 marks)

Carmella leaves home and walks north for 4.8 km, then west for 3.6 km and arrives at school.

a)
- **Sketch a vector diagram of this situation.**
- **What is the shortest distance between Carmella's school and her home?**
- **What direction must she take to follow this path home?**



direction: $\tan x = \frac{4.8}{3.6}$

$x = 53.13°$

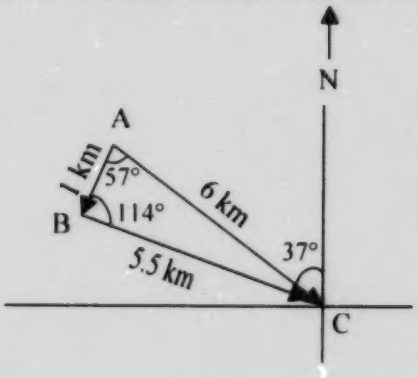
distance: $\sqrt{3.6^2 + 4.8^2} = 6$ km

distance = 6 km

direction = E 53° S or S 37° E

b) **Design another route for Carmella to return home from school assuming she must begin walking in a direction S 20° W.**

Sketch a route she could take and indicate all distances and directions.

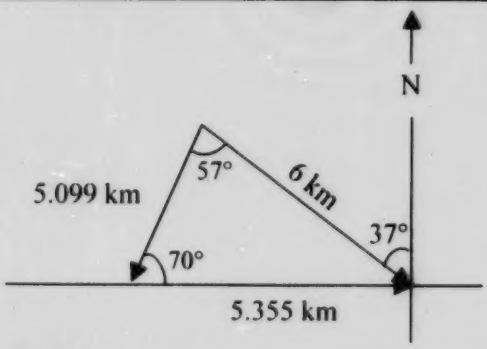


TriSolve:

A = 57°		a = 5.519 km
b = 6 km	⇒	B = 114.26°
c = 1 km		C = 8.74°

1 km S 20° E then 5.5 km E 44° S*

OR



5 km S 20° E then 5.4 km due E*

Scoring Rubric

	Score and General Performance Indicators	Specific Performance Indicators/Criteria
Level 1 limited understanding	**1** **weak attempt, inappropriate strategy or no strategy**	- 1 criterion correct
	2 **reasonable attempt, appropriate strategy with major errors or omissions**	- 2 criteria correct
Level 2 good understanding	**3** **reasonable strategy, minor errors and/or omissions**	- 3 criteria correct
	4 **sound strategy, mostly complete, minor errors**	- 4 criteria correct
	5 **almost complete and correct**	- 5 criteria correct
Level 3 exceptional understanding	**6** **complete and correct, reflecting exceptional understanding**	- 6 criteria correct

Criteria:

1) 1 mark for a reasonable diagram for a)
2) 1 mark for the correct distance in a)
3) 1 mark for the correct direction for a)
4) 1 mark for a reasonable diagram of alternate route starting at S 20° W in b)
5) 1 mark for the correct calculation of directions in b) (consistent with their diagram in a))
6) 1 mark for the correct calculation of distances in b) (consistent with their diagram in a))

Marker Notes:

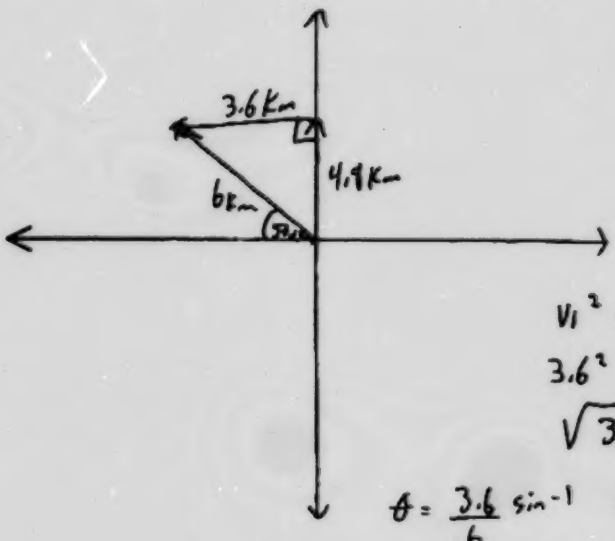
- **Answers other than the ones shown are possible.*

Student exemplar 1

Carmella leaves home and walks north for 4.8 km, then west for 3.6 km and arrives at school.

Total: 6 marks

a)
- Sketch a vector diagram of this situation.
- What is the shortest distance between Carmella's school and her home?
- What direction must she take to follow this path home?



She should walk 6 km at W 53.13° N

$v_1^2 + v_2^2 = v_r^2$

$3.6^2 + 4.8^2 = v_r^2$

$\sqrt{36} = \sqrt{v_r^2}$

$6\text{ km} = v_r$

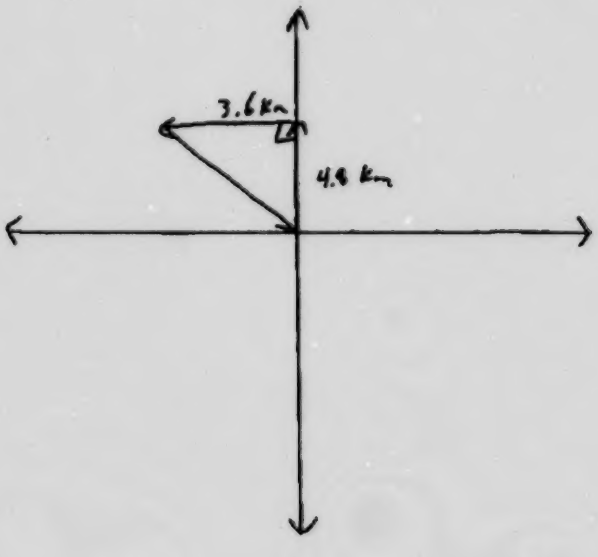
$\theta = \frac{3.6}{6} \sin^{-1}$

$\theta = N\,36.87°\,W$

$90 - 36.87 = 53.13°$

b) Design another route for Carmella to return home from school assuming she must begin walking in a direction S 20° W.

Sketch a route she could take and indicate all distances and directions.



2 marks:
- Correct diagram
- Correct calculations of distance and direction in a) but incorrect direction stated (reversed)
- No calculations for distances or directions in b)

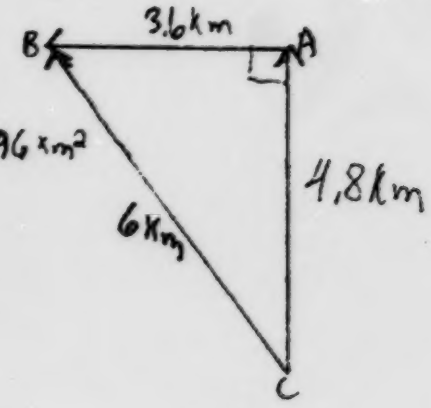
Student exemplar 2

Carmella leaves home and walks north for 4.8 km, then west for 3.6 km and arrives at school.

Total: 6 marks

a)
- Sketch a vector diagram of this situation.
- What is the shortest distance between Carmella's school and her home?
- What direction must she take to follow this path home?

$a^2 = b^2 + c^2$
$a^2 = 4.8\text{km}^2 + 36\text{km}^2$
$a^2 = 23.04\text{km}^2 - 12.96\text{km}^2$
$\sqrt{a^2} = \sqrt{36\text{ km}^2}$
$a = 6\text{km}$



b) Design another route for Carmella to return home from school assuming she must begin walking in a direction S 20° W.

Sketch a route she could take and indicate all distances and directions.

2 marks:
- Correct diagram
- Correct distance
- No calculation of direction in a)
- No calculations in b)

Student exemplar 3

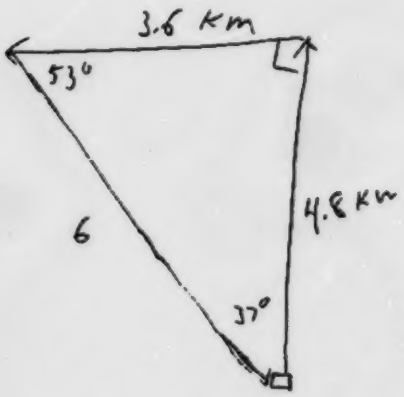
Carmella leaves home and walks north for 4.8 km, then west for 3.6 km and arrives at school.

Total: 6 marks

a)
- Sketch a vector diagram of this situation.
- What is the shortest distance between Carmella's school and her home?
- What direction must she take to follow this path home?

not to scale

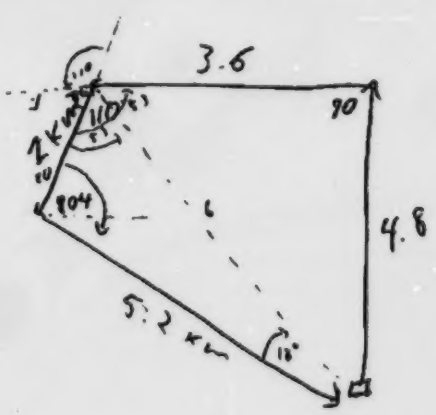
she should walk for 6 kms at E 53°S



b) Design another route for Carmella to return home from school assuming she must begin walking in a direction S 20° W.

Sketch a route she could take and indicate all distances and directions.

she should walk 2 km S20°W and then 5.2 km at W 34°S

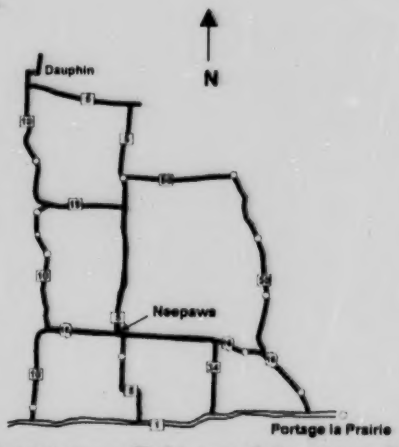


6 marks:
- Correct diagram
- Correct calculations of distance and direction in a)
- Correctly calculates new angle for b)
- Correct calculation of distances and direction for suitable route in b) with trivial error in describing direction

Specific Outcomes: D1, D3 **Item Type: Restricted Response**

Question No. 16 and Answer (3 marks)

Consider the map shown below.

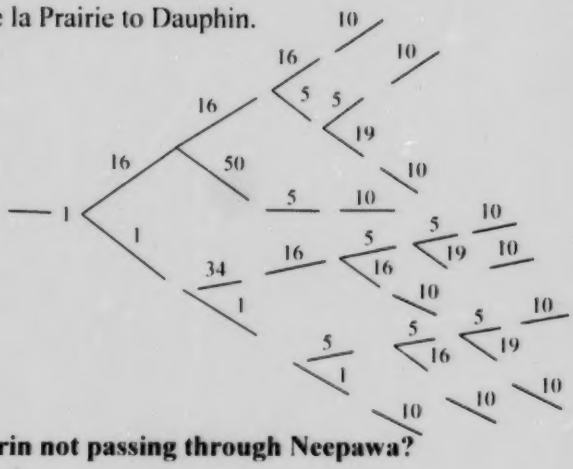


a) Calculate how many different ways Erin can drive from Portage la Prairie to Dauphin if she drives in the general direction north or west. Show how you arrived at your answer.

There are 11 ways to get from Portage la Prairie to Dauphin.

OR

There are 11 ways to go from Portage la Prairie to Dauphin.



b) What is the probability of Erin not passing through Neepawa?

Probability: 11 ways $\frac{2}{11} = 0.18$

OR

There are 2 ways not to go through Neepawa.

Probability: $\frac{2}{11} = 0.18$

Marking Key
1 mark for an appropriate strategy (e.g., an illustration or another supporting strategy for answer)
1 mark for the correct calculation in a)
1 mark for the correct probability in b)

Specific Outcomes: D4 **Item Type: Restricted Response with Explanation**

Question No. 17 and Answer (4 marks)

Santos, Ray and Aniko each shoot an arrow at a target once. The probabilities that they each hit the target are 0.1, 0.2 and 0.3 respectively.

a) What is the probability that all three will miss the target?

$$0.9 \times 0.8 \times 0.7 = 0.504$$

b) Fred wanted to calculate the probability that exactly two of the people hit the target. His calculation is shown:

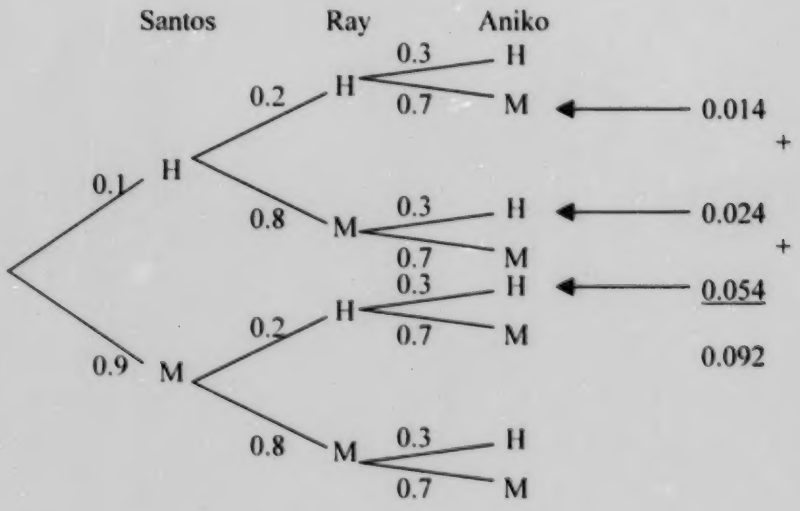
$$\mathbf{0.1 \times 0.2 \times 0.7 = 0.014}$$

Explain what is wrong with his calculation and determine the correct probability.

He assumed 1st two hit. There are 3 combinations to consider:*

1)	1st two hit	(0.1) (0.2) (0.7)	= 0.014	+
2)	last two hit	(0.9) (0.2) (0.3)	= 0.054	+
3)	1st and last hit	(0.1) (0.8) (0.3)	= 0.024	
			0.092	

OR



Marker Notes:

- **Explanations other than the one shown are possible.*

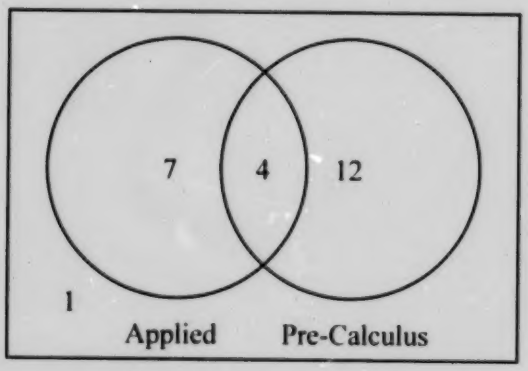
Marking Key
1 mark for the correct calculation of the complements in a) or b)
1 mark for the correct answer in a)
*1 mark for identifying the error in b)**
1 mark for determining correct probability in b)

Specific Outcomes: D3, D4 **Item Type: Restricted Response**

Question No. 18 and Answer (2 marks)

From a sample of 24 students, 11 are taking Applied Mathematics, 16 students are taking Pre-Calculus Mathematics and 4 students are taking both.

What is the probability of randomly choosing a student from the class that is neither in Applied Mathematics nor in Pre-Calculus Mathematics? Show how you arrived at your answer.



$$P = \frac{1}{24} = 0.042$$

Marker Notes:

- **Strategy could be shown without a diagram or with a different diagram than the one shown.*

Marking Key
1 mark for the correct answer *1 mark for an appropriate strategy **

Specific Outcomes: E1, E2, E3 **Item Type: Open Response**

Question No. 19 and Answer (4 marks)

The Royal Canadian Mint recently sampled the masses of their dimes and pennies to determine how accurately they were being produced. The masses were normally distributed.

a) The following table gives the frequencies of the pennies. Determine the mean and the <u>population</u> standard deviation of the data. Round your answer to 2 decimal places.

Mass (g)	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4
Frequency	2	15	57	120	138	109	54	14

$\bar{x} = 3.09$

$\sigma_x = 0.14$

<u>incomplete answer (worth 1 mark):</u>

Mass Data $\begin{cases} \bar{x} = 3.05 \\ \sigma_x = 0.23 \end{cases}$

OR

Frequency Data $\begin{cases} \bar{x} = 63.63 \\ \sigma_x = 49.41 \end{cases}$

b) Dimes are known to have a mean of 1.6 grams and a standard deviation of 0.11. Determine the *z*-score of a dime with a mass of 1.3 grams. Round your answer to 2 decimal places.

$$z = \frac{1.3 - 1.6}{0.11}$$
$$= -2.73$$

c) Explain how likely it is to produce a dime with a mass of 1.3 grams or less. Support your answer.

In a normal distribution only 2% of all data is more than 2 *z*-scores from the mean. In this case, a *z*-score of –2.73 means that there is less than 2% of the dimes with this mass, a rare event indeed.

OR

Normal CDF (–E99; 1.3; 1.6; 0.11) = 0.003 or 0.3% - very unlikely

Scoring Rubric

	Score and General Performance Indicators	Specific Performance Indicators/Criteria
Level 1 limited understanding	**1** **weak attempt, inappropriate strategy or no strategy**	- 1 criterion correct
Level 2 good understanding	**2** **reasonable attempt, appropriate strategy, minor errors and/or omissions**	- 2 criteria correct
	3 **complete and correct with minor errors**	- 3 criteria correct
Level 3 exceptional understanding	**4** **complete and correct, reflecting exceptional understanding**	- 4 criteria correct

Criteria:

1) 1 mark for an appropriate strategy in a) (i.e., correct answer for mean or standard deviation or an incomplete answer using mass or frequency data)
2) 1 mark for the correct answers for the standard deviation and mean in a)
3) 1 mark for the correct answer in b)
4) 1 mark for the correct support in c)

Marker Notes:

- *If students' answers are not rounded or not properly rounded - do not deduct marks.*

Student exemplar 1

Total: 4 marks

The Royal Canadian Mint recently sampled the masses of their dimes and pennies to determine how accurately they were being produced. The masses were normally distributed.

a) The following table gives the frequencies of the pennies. Determine the mean and the **population** standard deviation of the data. Round your answer to 2 decimal places.

Mass (g)	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4
Frequency	2	15	57	120	138	109	54	14

Mean = 125.38

Standard Deviation = 167.16

b) Dimes are known to have a mean of 1.6 grams and a standard deviation of 0.11. Determine the z-score of a dime with a mass of 1.3 grams. Round your answer to 2 decimal places.

-2.73 = Z score

$z = \frac{x - \bar{x}}{\sigma}$ $z = \frac{1.3 - 1.6}{.11}$

c) Explain how likely it is to produce a dime with a mass of 1.3 grams or less. Support your answer.

Not very likely.

Cause there is an eleven percent chance of getting a dime that is 1.3 grams and that is already over 2 standard deviations away from mean.

1 mark:

- Incorrect calculations and strategy in a)
- Correct calculations of z-score
- Incorrect concepts to support answer in c)

Student exemplar 2

Total: 4 marks

The Royal Canadian Mint recently sampled the masses of their dimes and pennies to determine how accurately they were being produced. The masses were normally distributed.

a) The following table gives the frequencies of the pennies. Determine the mean and the **population** standard deviation of the data. Round your answer to 2 decimal places.

Mass (g)	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4
Frequency	2	15	57	120	138	109	54	14

$\bar{X} = 3.09$

$\sigma X = .138$

b) Dimes are known to have a mean of 1.6 grams and a standard deviation of 0.11. Determine the z-score of a dime with a mass of 1.3 grams. Round your answer to 2 decimal places.

$$z = \frac{1.6 - 1.3}{.11}$$

$z = 2.73$

c) Explain how likely it is to produce a dime with a mass of 1.3 grams or less. Support your answer.

It is roughly 50% chance that a dime will weigh 1.3 grams

2 marks:

- Correct strategy and calculations for a)
- Incorrect answer and support in c)
- Incorrect z-score

Student exemplar 3

Total: 4 marks

The Royal Canadian Mint recently sampled the masses of their dimes and pennies to determine how accurately they were being produced. The masses were normally distributed.

a) The following table gives the frequencies of the pennies. Determine the mean and the **population** standard deviation of the data. Round your answer to 2 decimal places.

Mass (g)	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4
Frequency	2	15	57	120	138	109	54	14

Mean = 3.09

σ = .14

b) Dimes are known to have a mean of 1.6 grams and a standard deviation of 0.11. Determine the z-score of a dime with a mass of 1.3 grams. Round your answer to 2 decimal places.

$Z = \frac{x - \mu}{\sigma}$ $Z = \frac{1.3 - 1.6}{.11}$

$Z = -2.73$

c) Explain how likely it is to produce a dime with a mass of 1.3 grams or less. Support your answer.

It is not too likley that many Dimes will be under or at 1.3 grams as it falls almost 3 standard Deviations from average and only A small percent fall into that catagory

4 marks:

- Correct calculations in a) and b)
- Correct answer with reasonable support in c)

Specific Outcomes: E1, E3 **Item Type: Restricted Response with Explanation**

Question No. 20 and Answer (4 marks)

It is found that 40% of all students returning to school in September catch a common cold, while the rest do not. From among the students in a school, 600 students are randomly selected.

a) Determine the mean and the population standard deviation for the students who catch a cold.

$n = 600$ $\quad p = 0.4 \quad q = 0.6$

$\bar{x} = np$ $\quad \sigma = \sqrt{npq}$

$\bar{x} = 240$ $\quad \sigma = \sqrt{(600)(0.4)(0.6)}$

$\sigma = 12$

b) What is the 90% confidence interval for the mean number of students who will catch a cold in this group? Explain the meaning of your confidence interval.

z-interval (220.26; 259.74)

90% of the time, between 220 and 260 students will catch the common cold.

Marking Key
1 mark for the correct mean in a)
1 mark for the correct standard deviation in a)
1 mark for the correct confidence interval in b)
1 mark for a reasonable explanation presented in b)

Specific Outcomes: G1 **Item Type: Restricted Response**

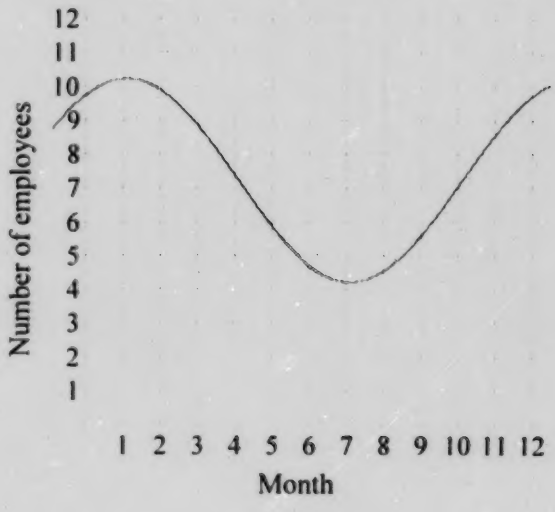
Question No. 21 and Answer (2 marks)

The number of people employed by a restaurant is modelled by the function (expressed in radians):

$$y = 3\sin(0.52x + 1) + 7.2$$

where x represents the month and y represents the number of people employed (assume January = month 1)

a) Sketch a graph for this function for one year.



b) What is the maximum number of people employed?

Maximum = (1.09; 10.2)

The maximum number of people employed is 10.

Marker Notes:

- *Award full marks if students state that the maximum is 10, 10.2 or 11 people*

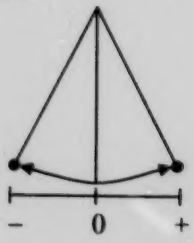
Marking Key
1 mark for a correct sketch *1 mark for the correct answer in b)*

Specific Outcomes: G2, G3 **Item Type: Restricted Response**

Question No. 22 and Answer (2 marks)

A pendulum is observed and data is collected as shown below. When the pendulum is to the right of its resting place, a positive distance is recorded. A negative distance indicates the pendulum is to the left of its resting place.

Time (sec.)	Distance (cm)
1.70	1.81
2.98	6.76
3.49	–7.89
4.77	–0.52
5.85	12.67



a) Write an equation to represent the sinusoidal motion of the pendulum.

$y = 14.96 \sin(2x + 3)$ where y = distance and x = time **OR** $y = 14.96 \sin(2x + 3.01) - 0.01$

b) What is the position of the pendulum when $t = 5$ seconds?

The pendulum is 6.18 cm (using sin reg.) **OR** 6.41 cm to the right of its resting place when $t = 5$ seconds.

OR

6.41 cm when $t = 5$ seconds.

OR

Manual solutions Answer for a)

If Max = (5.85, 12.67)
Min = (3.49, – 7.89)

$\frac{1}{2}$ period is $5.85 - 3.49 = 2.36$ Period is 4.72

$$\frac{2\pi}{4.72} = b$$
$$b = 1.33$$

Amplitude $\frac{12.67 - (-7.89)}{2} = 10.28$

Vertical shift is $-7.89 + 10.28 = 2.39$

Use (2.98, 6.76)

$$y = 10.28\sin(1.33x + c) + 2.39$$
$$6.76 = 10.28\sin[1.33(2.98) + c] + 2.39$$
$$\frac{4.37}{10.28} = \sin[3.963 + c]$$
$$0.425 = \sin[3.963 + c]$$
$$0.439 = 3.963 + c$$
$$-3.52 = c$$
$$y = 10.28\sin(1.33x - 3.52) + 2.39$$

Answer for b)

When $t = 5$ seconds

$y = 10.28\sin(1.33(5) - 3.52) + 2.39$

$y = 2.51$ $\therefore$ The pendulum is at 2.51 cm to the right of the resting place

Marker Notes:

- *If students solve the problem manually and assume 12.67 cm as being the maximum and –7.89 cm as the minimum, the horizontal shift can be any of the points - verify students' answer and award marks accordingly.*

Marking Key
1 mark for the correct answer in a) *1 mark for the correct answer in b)*

Specific Outcomes: G1 **Item Type: Restricted Response with Explanation**

Question No. 23 and Answer (3 marks)

The Great Canadian Bungee Company offers jumps from a 200-ft bridge. A jumper's height above the water for the first 10 seconds is modelled by:

$$y = 98\sin(0.63x + 1.5) + 102$$

where y is the height in feet and x is the time in seconds.

a) Determine the period and the amplitude.

amplitude = 98 feet

$$\text{period} = \frac{2\pi}{b} = \frac{6.28}{0.628} = 9.97 \text{ seconds}$$

OR

$Max_1 = (10.085\ 685, 200)$
$Max_2 = (20.058\ 995, 200)$

Period = 20.058 995 - 10.085 685
= 9.97

Note: Could also use two min. values or a max and min. values

b) Describe what the period represents in this situation.

It takes 9.97 seconds for the jumper to complete one down and up motion.*

Marker Notes:

- *Omitting units is a trivial error.*
- **Descriptions other than the one presented here are possible.*

Marking Key
1 mark for the correct period in a)
1 mark for the correct amplitude in a)
1 mark for the correct description in b)

Specific Outcomes: H1 **Item Type: Open Response**

Question No. 24 and Answer (5 marks)

Scientists have determined that 8 parts per million (ppm) of oil in water is an acceptable level. After an oil spill, the level of oil in a spill zone rises to 900 ppm. It is known that each week the spilled oil is reduced by 40%.

a) How many weeks will it take for the oil to be at an acceptable level? Explain how you arrived at your answer.

Week	Oil level (ppm)
0	900
1	(900 (0.6)) = 540
2	324
3	194.40
4	116.64
5	69.98

Week	Oil level (ppm)
6	41.99
7	25.19
8	15.12
9	9.07
10	5.44

Between 9 and 10 weeks

If 40% of the spilled oil dissipates, then 60% of the oil remains. So I took 60% of 900 ppm of oil repeated over time.

b) Chemicals could be added to the spill zone at the beginning of each week to speed up the process. There are two treatments available:

Treatment 1: oil is reduced by an additional 50 ppm at a cost $1 million per treatment
Treatment 2: oil is reduced by an additional 10 ppm at a cost $550 000 per treatment

Compare treatment 1 and 2 in order to recommend a treatment, if any.
Analyze the cost and time requirements for each treatment.
Support your answer by providing cost and time involved.

Treatment 1

Week	Oil level (ppm)
0	900
1	540
2	324
3	194
4	(117 – 50) (0.6) = 40.2
5	40.2 – 50 = 0

Use treatment 1 at weeks 4 and 5: Cost $2 000 000
I chose treatment 1 because it costs less and saves 5 weeks.*

Treatment 2

Week	Oil level (ppm)
0	900
1	540
2	324
3	(117 – 10) (0.6) = 64.2
4	(64.2 – 10) (0.6) = 32.5
5	(32.5 – 10) (0.6) = 13.5
6	13.5 – 10 = 3.5

Treatment 2 at weeks 3 to 6 costs: $2 200 000

OR

Treatment 1

Week	Oil level (ppm)
0	900 (0.6) – 50
1	490 (0.6) – 50
2	244 (0.6) – 50
3	96.4 (0.6) – 50
4	7.8

4 treatments: Cost $4 000 000
I chose treatment 2 because it costs less.*

Treatment 2

Week	Oil level (ppm)
0	900 (0.6) – 10
1	530 (0.6) – 10
2	308 (0.6) – 10
3	175 (0.6) – 10
4	95 (0.6) – 10
5	47 (0.6) – 10
6	18.2 (0.6) – 10
7	0.9

7 treatments: $3 850 000

OR

Treatment 1

Week	Oil level (ppm)
0	900
1	(900–50)(0.6) = 510
2	(510–50)(0.6) = 276
3	(135.6 – 50) (0.6) = 51.36
4	(51.36 – 50) (0.6) = 0.82
5	0.82

4 treatments needed: $4 000 000
saves 4 – 5 weeks — I chose treatment 1*

Treatment 2

Week	Oil level (ppm)
0	900
1	(900 – 10) (0.6) = 534
2	(534 – 10) (0.6) = 314.4
3	(314.4 – 10) (0.6) = 182.64
4	(182.64 – 10) (0.6) = 103.58
5	(103.58 – 10) (0.6) = 56.15
6	(56.15 – 10) (0.6) = 27.69
7	(27.69 – 10) (0.6) = 10.61
8	(10.61 – 10) (0.6) = 0.37

8 treatments needed: $4 400 000 $ saves 2 weeks

Scoring Rubric

	Score and General Performance Indicators	Specific Performance Indicators/Criteria
Level 1 limited understanding	**1** **weak attempt, inappropriate strategy or no strategy**	- 1 criterion correct
	2 **reasonable attempt, appropriate strategy with major errors or omissions**	- 2 criteria correct
Level 2 good understanding	**3** **reasonable strategy, minor errors and/or omissions**	- 3 criteria correct
	4 **sound strategy, mostly complete, minor errors**	- 4 criteria correct
Level 3 exceptional understanding	**5** **complete and correct, reflecting exceptional understanding**	- 5 criteria correct

Criteria:

1) 1 mark for the correct answer in a)
2) 1 mark for an appropriate strategy in a)
3) 1 mark for correct calculations for treatment 1
4) 1 mark for correct calculations for treatment 2
5) 1 mark for the comparison in b)

Marker Notes:

- **Other answers possible as long as they are well supported.*
- *For criteria 5), a student must compare the two treatments based on the given information.*
- *For criteria 5), the student must choose one of the treatments and support his/her choice based on either time or cost factors given.*

Student exemplar 1

Total: 5 marks

Scientists have determined that 8 parts per million (ppm) of oil in water is an acceptable level. After an oil spill, the level of oil in a spill zone rises to 900 ppm. It is known that each week the spilled oil is reduced by 40%.

a) How many weeks will it take for the oil to be at an acceptable level? Explain how you arrived at your answer.

900 x .40 = 360
360 x .40 = 144
144 x .40 = 57.6
57.6 x .40 = 23.04
23.04 x .40 = 9.22
9.22 x .40 = 3.69

It will take between 5 and 6 weeks.

b) Chemicals could be added to the spill zone at the beginning of each week to speed up the process. There are two treatments available:

Treatment 1: oil is reduced by an additional 50 ppm at a cost $1 million per treatment
Treatment 2: oil is reduced by an additional 10 ppm at a cost $550 000 per treatment

Compare treatment 1 and 2 in order to recommend a treatment, if any.
Analyze the cost and time requirements for each treatment.
Support your answer by providing cost and time involved.

Treatment 1 = 900 - 50 = 850 take 10 treatments.
10 x 1000 000 = 10 000 000

Treatment 2 = 900 - 10 = 890 take 90 treatments
90 x 550 000 = 49 500 000

1 mark:

- Appropriate strategy in a) but incorrect calculations in a) and b)

Student exemplar 2

Total: 5 marks

Scientists have determined that 8 parts per million (ppm) of oil in water is an acceptable level. After an oil spill, the level of oil in a spill zone rises to 900 ppm. It is known that each week the spilled oil is reduced by 40%.

a) How many weeks will it take for the oil to be at an acceptable level? Explain how you arrived at your answer.

week #	amount in water	end of week
1	900	540
2	540	324
3	324	194.4
4	194.4	116.64
5	116.64	69.98
6	69.98	41.99
7	41.99	25.19

it will take 10 weeks 5.443 ppm

b) Chemicals could be added to the spill zone at the beginning of each week to speed up the process. There are two treatments available:

Treatment 1: oil is reduced by an additional 50 ppm at a cost $1 million per treatment
Treatment 2: oil is reduced by an additional 10 ppm at a cost $550 000 per treatment

Compare treatment 1 and 2 in order to recommend a treatment, if any.
Analyze the cost and time requirements for each treatment.
Support your answer by providing cost and time involved.

2 marks:
- Correct answer in a) with appropriate strategy
- No analysis of treatment

Student exemplar 3

Total: 5 marks

Scientists have determined that 8 parts per million (ppm) of oil in water is an acceptable level. After an oil spill, the level of oil in a spill zone rises to 900 ppm. It is known that each week the spilled oil is reduced by 40%.

a) How many weeks will it take for the oil to be at an acceptable level? Explain how you arrived at your answer.

It would take 10 weeks

900 x 40% = 360 - 900 = 540 ppm 1st week
540 x 40% = 216 - 540 = 324 ppm 2nd week
324 x 40% = 129.6 - 324 = 194.4 ppm 3rd week
194.4 x 40% = 77.76 - 194.4 = 116.64 ppm 4th week
116.64 x 40% = 46.66 - 116.64 = 69.98 ppm 5th week
69.98 x 40% = 27.99 - 69.98 = 41.98 ppm 6th week
41.98 x 40% = 16.80 - 41.98 = 25.18 ppm 7th week
25.18 x 40% = 10.072 - 25.18 = 15.11 ppm 8th week
15.11 x 40% = 6.044 - 15.11 = 9.07 ppm 9th week
9.07 x 40% = 3.63 - 9.07 = 5.44 ppm 10th week

b) Chemicals could be added to the spill zone at the beginning of each week to speed up the process. There are two treatments available:

Treatment 1: oil is reduced by an additional 50 ppm at a cost $1 million per treatment
Treatment 2: oil is reduced by an additional 10 ppm at a cost $550 000 per treatment

Compare treatment 1 and 2 in order to recommend a treatment, if any.
Analyze the cost and time requirements for each treatment.
Support your answer by providing cost and time involved.

Treatment 1 is better for a fast hurried clean up but it is way more expensive.
Treatment 2 is for a slower clean up but is more affordable.

3 marks:
- Correct calculations in a) with appropriate strategy
- Correct comparison, but no calculations

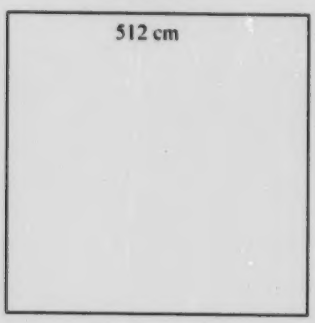
Specific Outcomes: H2, H3 **Item Type: Restricted Response**

Question No. 25 and Answer (2 marks)

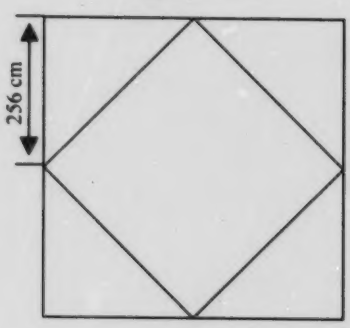
A sequence of inscribed squares is formed by joining the midpoints of the previous square. Each side of the original square is 512 cm long.

a) Continue the pattern for 1 more generation.

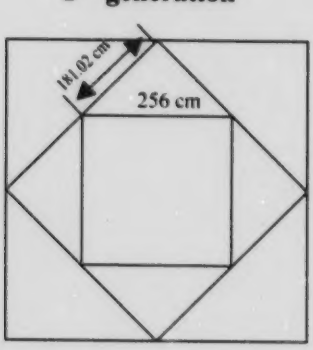
Original



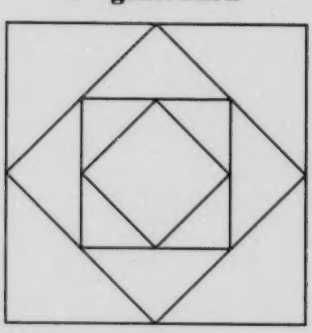
1st generation



2nd generation



3rd generation



b) Determine the area of the new square in the 3rd generation.

Original = 262 144 cm^2
1st generation = 131 072 cm^2
2nd generation = 65 536 cm^2
3rd generation = 32 768 cm^2
or 32 761 cm^2 (rounding off)

Marker Notes:

- *Do not deduct marks for missing units.*
- *Students' answers will vary depending on rounding operations.*

Marking Key
1 mark for the correct answer in a)
1 mark for the correct answer in b)

Marking Keys and Scoring Rubrics for the Inquiry Task

Specific Outcomes: C1, C3 **Item Type: Restricted Response with Explanation**

Inquiry Task Question No. 1 and Answer (10 marks)

PERSONAL FINANCE

Maila just graduated and has decided to treat herself by getting a new car. The local dealer has a special on a new compact car with a purchase price of $17 036.00. She plans to own the car for 4 years.

Option 1 – Lease the car

Down Payment:	**$2785.00**
Monthly Lease Payment:	**$199.00 (taxes included) for 48 months**
Purchase Price Option at end of Lease:	**$7740.00**

Since she only wants the car for 4 years, under this option she would not exercise her option to purchase the car and would return it to the dealer.

a) Calculate the total cost of leasing the car for the 4 years.

$2785 + 48 ($199) = $12 337.00

Option 2 – Purchase the car

Purchase Price:	**$17 036.00**	**(plus PST and GST)**
Down Payment:	**$2785.00**	
Finance Rate:	**1.9% per annum, compounded monthly**	

Under this option, she would sell the car after 4 years. She assumes that she will be able to sell it for the lease return price of $7740.00.

b) Calculate the total cost of purchasing the car and selling it after 4 years for $7740.00.

Total Price = $17 036 + $1192.52 (PST) + $1192.52 (GST) = $19 421.04
Amount to be financed = $19 421.04 – $2785.00 = $16 636.04
Monthly Payment (TVM solver) = $360.20 or $359.63
Total Cost = $360.20 × 48 + $2785 = $20 074.60 – $7740.00 = $12 334.60 or $12 307.24

c) Give two reasons why a person might lease a car rather than buy it.

- Lower monthly payments

or

- Always want to have a new car

or

- Less tax to start with

d) If a car is worth $7740 and depreciates 6% a year, what will the car be worth after 3 years? Indicate how you arrived at your answer.

$$\$7740 \times (1.00 \times 0.06) = \$7275.60$$
$$\$7275.60 \times (1.00 \times 0.06) = \$6839.06$$
$$\$6839.06 \times (1.00 \times 0.06) = \$6428.72$$

The car will be worth $6428.72 after 3 years worth of depreciation based on 6% depreciation per year.

Marking Key
1 mark for the correct answer in a)
1 mark for calculating the total price in b)
1 mark for calculating the amount to be financed in b)
1 mark for calculating the monthly payment in b)
2 marks for calculating the total cost in b) (i.e., total cost including down payment)
2 marks for the correct reasons in c) (reasons other than the ones presented are possible)
1 mark for an appropriate strategy in d)
1 mark for the correct answer in d)

Student exemplar 1

Total: 10 marks

Maila just graduated and has decided to treat herself by getting a new car. The local dealer has a special on a new compact car with a purchase price of $17 036.00. She plans to own the car for 4 years.

Option 1 – Lease the car

Down Payment:	$2785.00
Monthly Lease Payment:	$199.00 (taxes included) for 48 months
Purchase Price Option at end of Lease:	$7740.00

Since she only wants the car for 4 years, under this option she would not exercise her option to purchase the car and would return it to the dealer.

a) Calculate the total cost of leasing the car for the 4 years.

1 mark

Month	Opening Balance	Monthly Payment	Principal Reduction	Closing Balance
1	$14,251.00	$199.00	$199.00	$14,052.00
2	$14,052.00	$199.00	$199.00	$13,853.00
3	$13,853.00	$199.00	$199.00	$13,654.00
4	$13,654.00	$199.00	$199.00	$13,455.00
5	$13,455.00	$199.00	$199.00	$13,256.00
6	$13,256.00	$199.00	$199.00	$13,057.00
7	$13,057.00	$199.00	$199.00	$12,858.00
8	$12,858.00	$199.00	$199.00	$12,659.00
9	$12,659.00	$199.00	$199.00	$12,460.00
10	$12,460.00	$199.00	$199.00	$12,261.00
11	$12,261.00	$199.00	$199.00	$12,062.00
12	$12,062.00	$199.00	$199.00	$11,863.00
13	$11,863.00	$199.00	$199.00	$11,664.00
14	$11,664.00	$199.00	$199.00	$11,465.00
15	$11,465.00	$199.00	$199.00	$11,266.00
16	$11,266.00	$199.00	$199.00	$11,067.00
17	$11,067.00	$199.00	$199.00	$10,868.00
18	$10,868.00	$199.00	$199.00	$10,669.00
19	$10,669.00	$199.00	$199.00	$10,470.00
20	$10,470.00	$199.00	$199.00	$10,271.00
21	$10,271.00	$199.00	$199.00	$10,072.00
22	$10,072.00	$199.00	$199.00	$9,873.00
23	$9,873.00	$199.00	$199.00	$9,674.00
24	$9,674.00	$199.00	$199.00	$9,475.00
25	$9,475.00	$199.00	$199.00	$9,276.00
26	$9,276.00	$199.00	$199.00	$9,077.00
27	$9,077.00	$199.00	$199.00	$8,878.00
28	$8,878.00	$199.00	$199.00	$8,679.00
29	$8,679.00	$199.00	$199.00	$8,480.00
30	$8,480.00	$199.00	$199.00	$8,281.00
31	$8,281.00	$199.00	$199.00	$8,082.00
32	$8,082.00	$199.00	$199.00	$7,883.00
33	$7,883.00	$199.00	$199.00	$7,684.00
34	$7,684.00	$199.00	$199.00	$7,485.00
35	$7,485.00	$199.00	$199.00	$7,286.00
36	$7,286.00	$199.00	$199.00	$7,087.00
37	$7,087.00	$199.00	$199.00	$6,888.00
38	$6,888.00	$199.00	$199.00	$6,689.00
39	$6,689.00	$199.00	$199.00	$6,490.00
40	$6,490.00	$199.00	$199.00	$6,291.00
41	$6,291.00	$199.00	$199.00	$6,092.00
42	$6,092.00	$199.00	$199.00	$5,893.00
43	$5,893.00	$199.00	$199.00	$5,694.00
44	$5,694.00	$199.00	$199.00	$5,495.00
45	$5,495.00	$199.00	$199.00	$5,296.00
46	$5,296.00	$199.00	$199.00	$5,097.00
47	$5,097.00	$199.00	$199.00	$4,898.00
48	$4,898.00	$199.00	$199.00	$4,699.00

Option 2 – Purchase the car

Purchase Price:	$17 036.00	(plus PST and GST)
Down Payment:	$2785.00	
Finance Rate:	1.9% per annum, compounded monthly	

Under this option, she would sell the car after 4 years. She assumes that she will be able to sell it for the lease return price of $7740.00.

b) Calculate the total cost of purchasing the car and selling it after 4 years for $7740.00.

5 marks

15056.28 - 7740 = 7316.28

She still owes $7316.28

Month	Opening Balance	Interest	Principal Reduction	Closing Balance
1	$16,246.14	$25.72	$25.72	$16,220.42
2	$16,220.42	$25.68	$25.68	$16,194.73
3	$16,194.73	$25.64	$25.64	$16,169.09
4	$16,169.09	$25.60	$25.60	$16,143.49
5	$16,143.49	$25.56	$25.56	$16,117.93
6	$16,117.93	$25.52	$25.52	$16,092.41
7	$16,092.41	$25.48	$25.48	$16,066.93
8	$16,066.93	$25.44	$25.44	$16,041.49
9	$16,041.49	$25.40	$25.40	$16,016.09
10	$16,016.09	$25.36	$25.36	$15,990.73
11	$15,990.73	$25.32	$25.32	$15,965.42
12	$15,965.42	$25.28	$25.28	$15,940.14
13	$15,940.14	$25.24	$25.24	$15,914.90
14	$15,914.90	$25.20	$25.20	$15,889.70
15	$15,889.70	$25.16	$25.16	$15,864.54
16	$15,864.54	$25.12	$25.12	$15,839.42
17	$15,839.42	$25.08	$25.08	$15,814.34
18	$15,814.34	$25.04	$25.04	$15,789.30
19	$15,789.30	$25.00	$25.00	$15,764.30
20	$15,764.30	$24.96	$24.96	$15,739.34
21	$15,739.34	$24.92	$24.92	$15,714.42
22	$15,714.42	$24.88	$24.88	$15,689.54
23	$15,689.54	$24.84	$24.84	$15,664.70
24	$15,664.70	$24.80	$24.80	$15,639.90
25	$15,639.90	$24.76	$24.76	$15,615.14
26	$15,615.14	$24.72	$24.72	$15,590.41
27	$15,590.41	$24.68	$24.68	$15,565.73
28	$15,565.73	$24.65	$24.65	$15,541.08
29	$15,541.08	$24.61	$24.61	$15,516.47
30	$15,516.47	$24.57	$24.57	$15,491.91
31	$15,491.91	$24.53	$24.53	$15,467.38
32	$15,467.38	$24.49	$24.49	$15,442.89
33	$15,442.89	$24.45	$24.45	$15,418.44
34	$15,418.44	$24.41	$24.41	$15,394.02
35	$15,394.02	$24.37	$24.37	$15,369.65
36	$15,369.65	$24.34	$24.34	$15,345.31
37	$15,345.31	$24.30	$24.30	$15,321.02
38	$15,321.02	$24.26	$24.26	$15,296.76
39	$15,296.76	$24.22	$24.22	$15,272.54
40	$15,272.54	$24.18	$24.18	$15,248.36
41	$15,248.36	$24.14	$24.14	$15,224.21
42	$15,224.21	$24.11	$24.11	$15,200.11
43	$15,200.11	$24.07	$24.07	$15,176.04
44	$15,176.04	$24.03	$24.03	$15,152.01
45	$15,152.01	$23.99	$23.99	$15,128.02
46	$15,128.02	$23.95	$23.95	$15,104.07
47	$15,104.07	$23.91	$23.91	$15,080.16
48	$15,080.16	$23.88	$23.88	$15,056.28

c) Give two reasons why a person might lease a car rather than buy it.

2 marks

Cheaper
Change in vehicles

d) If a car is worth $7740 and depreciates 6% a year, what will the car be worth after 3 years? Indicate how you arrived at your answer.

2 marks

1 mark:

- 1 mark for correct answer in c) (cheaper - no mark given)

Student exemplar 2

Total: 10 marks

Maila just graduated and has decided to treat herself by getting a new car. The local dealer has a special on a new compact car with a purchase price of $17 036.00. She plans to own the car for 4 years.

Option 1 – Lease the car

Down Payment:	$2785.00
Monthly Lease Payment:	$199.00 (taxes included) for 48 months
Purchase Price Option at end of Lease:	$7740.00

Since she only wants the car for 4 years, under this option she would not exercise her option to purchase the car and would return it to the dealer.

a) Calculate the total cost of leasing the car for the 4 years.

1 mark

17 036.00

months

199.00 x 48 = 9552.00

9552.00 + 2785.00 = $12337.00

assumed that all numbers include both taxes

Total cost for leasing the car for the 4 years is $12 337.00

Option 2 – Purchase the car

Purchase Price:	$17 036.00	(plus PST and GST)
Down Payment:	$2785.00	
Finance Rate:	1.9% per annum, compounded monthly	

Under this option, she would sell the car after 4 years. She assumes that she will be able to sell it for the lease return price of $7740.00.

b) Calculate the total cost of purchasing the car and selling it after 4 years for $7740.00.

5 marks

17036.00 ÷ 48 = 354.92 per month

17036.00
+ 2785.00
$19821.00

376.60 x 48

$19821.00 - $7740.00

= $12081.00 total purchasing price after 4 years minus the $7740.00 for selling it.

c) Give two reasons why a person might lease a car rather than buy it.

2 marks

- They would rather drive a new car every 4 years
- They don't want to worry to much about maintenance

d) If a car is worth $7740 and depreciates 6% a year, what will the car be worth after 3 years? Indicate how you arrived at your answer.

2 marks

3 marks:

- 1 mark for answer in a)
- 2 marks for correct reasons in c)

Student exemplar 3

Total: 10 marks

Maila just graduated and has decided to treat herself by getting a new car. The local dealer has a special on a new compact car with a purchase price of $17 036.00. She plans to own the car for 4 years.

Option 1 – Lease the car

Down Payment:	$2785.00
Monthly Lease Payment:	$199.00 (taxes included) for 48 months
Purchase Price Option at end of Lease:	$7740.00

Since she only wants the car for 4 years, under this option she would not exercise her option to purchase the car and would return it to the dealer.

a) Calculate the total cost of leasing the car for the 4 years.

1 mark

Down Payment + Monthly Lease Payment (48)
total cost of leasing car for 4 yrs.

$2785 + ($199.48 mths) =

$2785 + $9552 = $12,337

= Total cost of leasing car for 4 yrs
= $12,337

Option 2 – Purchase the car

Purchase Price:	$17 036.00	(plus PST and GST)
Down Payment:	$2785.00	
Finance Rate:	1.9% per annum, compounded monthly	

Under this option, she would sell the car after 4 years. She assumes that she will be able to sell it for the lease return price of $7740.00.

b) Calculate the total cost of purchasing the car and selling it after 4 years for $7740.00.

5 marks

Total cost of purch + selling =

$17036 × 1.14 = $19,421.04 − $2785 = $16636.04

Purchase $ − Down pay = Loan

$16636.04 × monthly interest

c) Give two reasons why a person might lease a car rather than buy it.

2 marks

• Because they do not want the hassel of trying to sell the car eventualy

• Because they want a car now & don't have enough money saved up ~~for a~~ to buy a car. cash.

d) If a car is worth $7740 and depreciates 6% a year, what will the car be worth after 3 years? Indicate how you arrived at your answer.

2 marks

5 marks:

- 1 mark for answer in a)
- 2 marks in b) for total price and financing
- 2 marks for correct reasons in c)

Student exemplar 4

Total: 10 marks

Maila just graduated and has decided to treat herself by getting a new car. The local dealer has a special on a new compact car with a purchase price of $17 036.00. She plans to own the car for 4 years.

Option 1 – Lease the car

Down Payment:	$2785.00
Monthly Lease Payment:	$199.00 (taxes included) for 48 months
Purchase Price Option at end of Lease:	$7740.00

Since she only wants the car for 4 years, under this option she would not exercise her option to purchase the car and would return it to the dealer.

a) Calculate the total cost of leasing the car for the 4 years.

1 mark

48 months x 199 = $9552.00

Down payment = $2785.00

$12337.00

The total cost of leasing for 4 years is $12337.00.

Option 2 – Purchase the car

Purchase Price:	$17 036.00	(plus PST and GST)
Down Payment:	$2785.00	
Finance Rate:	1.9% per annum, compounded monthly	

Under this option, she would sell the car after 4 years. She assumes that she will be able to sell it for the lease return price of $7740.00.

b) Calculate the total cost of purchasing the car and selling it after 4 years for $7740.00.

5 marks

N = 48

I% = 1.9

PV = 17 036 + 2(17036*0.07) - 2785

= 16636.04

PMT = -359.63

FV = 0

P/Y = 12

C/Y = 12

Total payment = 359.63 x 48

= $17262.24

The total cost is $9522.24.

- 7740.00

$9522.24

c) Give two reasons why a person might lease a car rather than buy it.

2 marks

One reason is they might use their vechicle for travel and it wouldn't make to buy a new one every time it wore out. another reason is that they pay less per month.

d) If a car is worth $7740 and depreciates 6% a year, what will the car be worth after 3 years? Indicate how you arrived at your answer.

2 marks

$\$7740 \times (1.00 \times 0.06) = \$7275.60$

$\$7275.60 \times (1.00 \times 0.06) = \$6839.06$

$\$6839.06 \times (1.00 \times 0.06) = \$6428.72$

The car will be worth $6428.72 after 3 years worth of depreciation.

9 marks:

- Full marks - minus 1 mark for forgetting down payment in the total cost in b)

Student exemplar 5

Total: 10 marks

Maila just graduated and has decided to treat herself by getting a new car. The local dealer has a special on a new compact car with a purchase price of $17 036.00. She plans to own the car for 4 years.

Option 1 – Lease the car

Down Payment:	$2785.00
Monthly Lease Payment:	$199.00 (taxes included) for 48 months
Purchase Price Option at end of Lease:	$7740.00

Since she only wants the car for 4 years, under this option she would not exercise her option to purchase the car and would return it to the dealer.

a) Calculate the total cost of leasing the car for the 4 years.

1 mark

$199 x 48 = $9552.00
+ Down Payment of $2785.00
$12337.00

Option 2 – Purchase the car

Purchase Price:	$17 036.00	(plus PST and GST)
Down Payment:	$2785.00	
Finance Rate:	1.9% per annum, compounded monthly	

Under this option, she would sell the car after 4 years. She assumes that she will be able to sell it for the lease return price of $7740.00.

b) Calculate the total cost of purchasing the car and selling it after 4 years for $7740.00.

5 marks

Purchase Price = $17036.00
Down Payment = $2785.00
Finance Rate 1.9%

4 years = 48 months.

$19421.01 - $2785.00 = $16636.01 Loan Amt.

Payment per month $360.14

Total Cost of Buying is $ 20,071.72

$20071.72 - 7740 = $ 12331.72

c) Give two reasons why a person might lease a car rather than buy it.

2 marks

Because the monthly payments are usually lower when you lease. You can always bring it back to the dealership when your lease is up, rather than trying to find a buyer if you purchase the car.

d) If a car is worth $7740 and depreciates 0.6% a year, what will the car be worth after 3 years? Indicate how you arrived at your answer.

2 marks

$7740 × (1.00 × 0.06) = $7275.60
$7275.60 × (1.00 × 0.06) = $6839.06
$6839.06 × (1.00 × 0.06) = $6428.72
The car will be worth $6428.72 after 3 years

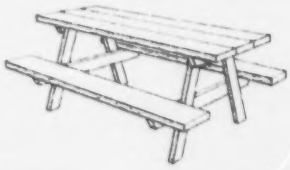
10 marks:

- Trivial difference in monthly payment $360.20 vs. $360.14

Inquiry Task Question No. 2 and Answer (10 marks)

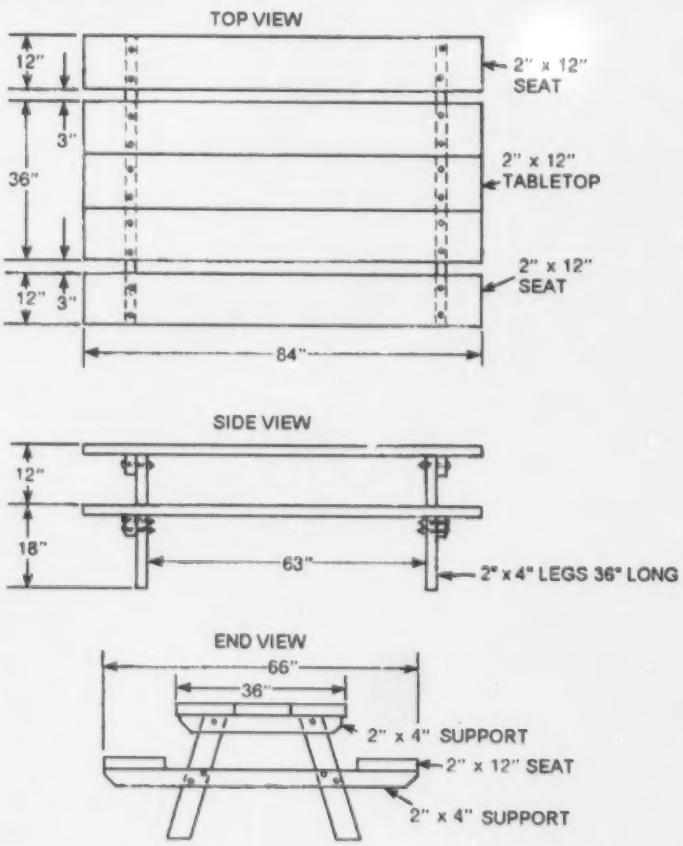
DESIGN AND MEASUREMENT

A picnic table forms the center of activity for most outdoor gatherings, and the traditional picnic table shown here is big enough to comfortably seat a large group for an outdoor get-together. Since you have decided to build one, it is necessary for you to determine the amount of material necessary to accomplish the task.



The picnic table as illustrated will be constructed using 2 inches by 4 inches (2" × 4") and 2 inches by 12 inches (2" × 12") lumber. The lengths and prices of this lumber are found in the materials list shown on the next page. The cost of miscellaneous hardware such as nails, screws and bolts is included in this materials list as well.

Different views of the picnic table:



(Total marks: 10 marks)

Do not substitute 2" by 12" pieces with 2" by 4" pieces.
Lumber is sold in pre-cut lengths as shown below.

Materials List		
Type	**Length**	**Unit Price**
2" × 4"	8'	$2.48
2" × 4"	10'	$2.70
2" × 4"	12'	$3.24
2" × 4"	14'	$4.28
2" × 4"	16'	$4.98
2" × 12"	8'	$7.02
2" × 12"	10'	$8.78
2" × 12"	12'	$11.52
2" × 12"	14'	$17.64
2" × 12"	16'	$22.90
Miscellaneous Hardware for one table (nails, screws, bolts)		$20.00

QUESTIONS

2a) **By providing a detailed cost analysis, show how you can build the table for under $85.00 including taxes. Specify how you are using the lumber for the different parts of the table. State any assumptions you have made.**

Organization of your work will be a factor in marking. (Space for response is provided on the next page.)

2" × 12"	8'	: 5 pieces	top and benches
2" × 4"	5.5'	: 2 pieces	supports for seats
2" × 4"	3'	: 2 pieces	supports for table top
2" × 4"	3'	: 4 pieces	legs

Without formulas

	Length	Unit Price	Number Required	Cost
2" × 4"	8'	$2.48		$0.00
	10'	$2.70		$0.00
	12'	$3.24		$0.00
	14'	$4.28	1	$4.28
	16'	$4.98	1	$4.98
2" × 12"	8'	$7.02	5	$35.10
	10'	$8.78		$0.00
	12'	$11.52		$0.00
	14'	$17.64		$0.00
	16'	$22.90		$0.00
Miscellaneous Hardware (nails, screws, bolts)				$20.00
			Sub-total	$64.36
			PST/GST	$9.01
			Total Cost	$73.37

With formulas

Type	Length	Unit Price	Number Required	Cost
2" × 4"	8'	$2.48		=C2*D2
2" × 4"	10'	$2.70		=C3*D3
2" × 4"	12'	$3.24		=C4*D4
2" × 4"	14'	$4.28	1	=C5*D5
2" × 4"	16'	$4.98	1	=C6*D6
2" × 12"	8'	$7.02	5	=C7*D7
2" × 12"	10'	$8.78		=C8*D8
2" × 12"	12'	$11.52		=C9*D9
2" × 12"	14'	$17.64		=C10*D!0
2" × 12"	16'	$22.90		=C11*D11
Miscellaneous Hardware (nails, screws, bolts)				$20.00
			Sub-total	=SUM(E2:E13)
			PST/GST	=E15*0.14
			Total Cost	=E15+E16

2b) Two neighbours decide to get together and build two tables. Indicate the specific materials to be purchased, and calculate the minimum cost for building the two tables.

Type	Length	Unit Price	Number Required	Cost
2" × 4"	8'	$2.48		$0.00
2" × 4"	10'	$2.70		$0.00
2" × 4"	12'	$3.24	5	$16.20
2" × 4"	14'	$4.28		$0.00
2" × 4"	16'	$4.98		$0.00
2" × 12"	8'	$7.02	10	$70.20
2" × 12"	10'	$8.78		$0.00
2" × 12"	12'	$11.52		$0.00
2" × 12"	14'	$17.64		$0.00
2" × 12"	16'	$22.90		$0.00
Miscellaneous Hardware (nails, screws, bolts) for two tables				$40.00
			Sub-total	$126.40
			PST/GST	$17.70
			Total Cost	$144.10

Scoring Rubric

	Score and General Performance Indicators	Specific Performance Indicators/Criteria
Level 1 limited understanding	**1** **weak attempt, inappropriate strategy or no strategy**	- any combination of criteria for 1 mark
	2 **reasonable attempt, inappropriate strategy, major errors or omissions**	- any combination of criteria for 2 marks
	3 **reasonable attempt, inappropriate strategy but carried through correctly**	- any combination of criteria for 3 marks
Level 2 good understanding	**4** **sound strategy with major errors**	- any combination of criteria for 4 marks
	5 **sound strategy with minor errors**	- any combination of criteria for 5 marks
	6 **mostly complete with some omissions**	- any combination of criteria for 6 marks
	7 **close to complete and correct, major errors**	- any combination of criteria for 7 marks
Level 3 exceptional understanding	**8** **close to complete and correct, minor errors**	- any combination of criteria for 8 marks
	9 **almost complete and correct, trivial errors**	- any combination of criteria for 9 marks
	10 **complete and correct, reflecting exceptional understanding**	- any combination of criteria for 10 marks

Criteria:

Part a):
1) *3 marks for correct assessment of number of 2" × 4" (description and correct numbers of supports for seats, supports for table tops and legs)*
2) *1 mark for correct assessment of number of 2" × 12"*
3) *1 mark for keeping cost under $85.00 as long as there is enough wood to build the table*
4) *1 mark for assumption/organization*
5) *1 mark for total costs including hardware costs and/or taxes*

Part b):
6) *1 mark for doubling hardware costs and 2" × 12" lumber costs*
7) *1 mark for adjusting the number of 2" × 4" so their cost is less than doubling*
8) *1 mark for $144.10 as final cost or as a minimum cost based on earlier work (consistency)*

Marker Notes:

- *Deduct 1 mark if student does not double hardware costs*

Student exemplar 1

Total: 10 marks

Do not substitute 2" by 12" pieces with 2" by 4" pieces.
Lumber is sold in pre-cut lengths as shown below.

Materials List		
Type	**Length**	**Unit Price**
2" × 4"	8'	$2.48
2" × 4"	10'	$2.70
2" × 4"	12'	$3.24
2" × 4"	14'	$4.28
2" × 4"	16'	$4.98
2" × 12"	8'	$7.02
2" × 12"	10'	$8.78
2" × 12"	12'	$11.52
2" × 12"	14'	$17.64
2" × 12"	16'	$22.90
Miscellaneous Hardware for one table (nails, screws, bolts)		$20.00

QUESTIONS

2a) By providing a detailed cost analysis, show how you can build the table for under $85.00 including taxes. Specify how you are using the lumber for the different parts of the table. State any assumptions you have made.

Organization of your work will be a factor in marking. (Space for response is provided on the next page.)

5 = 2"x12' each 84" long

84" ÷ 12 = 7. Buy 4-14' boards plus 1 8' board.

6-2"x4" for legs and 2 supports.
each 36" long

36 ÷ 12 = 3

3x6 = 18 Buy 1-8' board and 1-10' board

2- for other supports

66" ÷ 12' = 5.5' 2x5.5=11. Buy 1 12' board.

Type	Length	Unit Price	Number Required	Total Cost
2x4	8	2.48	1	$2.48
2x4	10	2.7	2	$5.40
2x4	12	3.24		
2x4	14	4.28		
2x4	16	4.98		
2x12	8	7.02	1	$7.02
2x12	10	8.78		
2x12	12	11.52		
2x12	14	17.64	4	$70.56
2x12	16	22.9		
			Subtotal	$85.46
			pst/gst total cost	$97.42

Type	Length	Unit Pric	Number Required	Total Cost
2x4	8	2.48	1	=D2*C2
2x4	10	2.7	2	=D3*C3
2x4	12	3.24		
2x4	14	4.28		
2x4	16	4.98		
2x12	8	7.02	1	=D10*C10
2x12	10	8.78		
2x12	12	11.52		
2x12	14	17.64	4	=D13*C13
2x12	16	22.9		
			Subtotal	=E2+E3+E10+E13
			pst/gst total cost	=E15*1.14

2b) Two neighbours decide to get together and build two tables. Indicate the specific materials to be purchased, and calculate the minimum cost for building the two tables.

Type	Length	Unit Price	Number Required	Total Cost
2x4	8	2.48	1	$4.96
2x4	10	2.7	2	$10.80
2x4	12	3.24		
2x4	14	4.28		
2x4	16	4.98		
2x12	8	7.02	1	$14.04
2x12	10	8.78		
2x12	12	11.52		
2x12	14	17.64	4	$141.12
2x12	16	22.9		
			Subtotal	$170.92
			pst/gst total cost	$194.85

4 marks:

- 2 marks for criteria 1
- 1 mark for organization
- 1 mark for including taxes

Student exemplar 2

Total: 10 marks

Do not substitute 2" by 12" pieces with 2" by 4" pieces.
Lumber is sold in pre-cut lengths as shown below.

Materials List		
Type	**Length**	**Unit Price**
2" × 4"	8'	$2.48
2" × 4"	10'	$2.70
2" × 4"	12'	$3.24
2" × 4"	14'	$4.28
2" × 4"	16'	$4.98
2" × 12"	8'	$7.02
2" × 12"	10'	$8.78
2" × 12"	12'	$11.52
2" × 12"	14'	$17.64
2" × 12"	16'	$22.90
Miscellaneous Hardware for one table (nails, screws, bolts)		$20.00

QUESTIONS

2a) By providing a detailed cost analysis, show how you can build the table for under $85.00 including taxes. Specify how you are using the lumber for the different parts of the table. State any assumptions you have made.

Organization of your work will be a factor in marking. (Space for response is provided on the next page.)

I will use 5 2"x12" which are 8' long for the two seats and the table top pieces.
AND I will use 5 2x4 which are 8' long for the legs and supports

type	length	price	number required	total cost
2x4	8	$2.48	5	$12.40
2x4	10	$2.70		$0.00
2x4	12	$3.24		$0.00
2x4	14	$4.28		$0.00
2x4	16	$4.98		$0.00
2x12	8	$7.02	5	$35.10
2x12	10	$8.78		$0.00
2x12	12	$11.52		$0.00
2x12	14	$17.64		$0.00
2x12	16	$22.90		$0.00
			Hardware	$20.00
			taxes	1.14
			total	$76.95

type	length	price	number required	total cost
2x4	8	2.48	5	=D2*C2
2x4	10	2.7		=C3*D3
2x4	12	3.24		=C4*D4
2x4	14	4.28		=C5*D5
2x4	16	4.98		=C6*D6
2x12	8	7.02	5	=C8*D8
2x12	10	8.78		=C9*D9
2x12	12	11.52		=C10*D10
2x12	14	17.64		=C11*D11
2x12	16	22.9		=C12*D12
			Hardware	=20
			taxes	=1.14
			total	=SUM(E2:E13)*1.14

2b) Two neighbours decide to get together and build two tables. Indicate the specific materials to be purchased, and calculate the minimum cost for building the two tables.

type	length	price	number required	total cost
2x4	8	$2.48	10	$24.80
2x4	10	$2.70		$0.00
2x4	12	$3.24		$0.00
2x4	14	$4.28		$0.00
2x4	16	$4.98		$0.00
2x12	8	$7.02	10	$70.20
2x12	10	$8.78		$0.00
2x12	12	$11.52		$0.00
2x12	14	$17.64		$0.00
2x12	16	$22.90		$0.00
			Hardware	$20.00
			taxes	1.14
			total	$131.10

6 marks:

- 1 mark for 2" × 12"
- 2 marks for 2" × 4"
- 1 mark for cost under $85.00
- 1 mark for organization
- 1 mark for total cost including hardware costs and taxes

Student exemplar 3

Total: 10 marks

Do not substitute 2" by 12" pieces with 2" by 4" pieces.
Lumber is sold in pre-cut lengths as shown below.

Materials List		
Type	**Length**	**Unit Price**
2" × 4"	8'	$2.48
2" × 4"	10'	$2.70
2" × 4"	12'	$3.24
2" × 4"	14'	$4.28
2" × 4"	16'	$4.98
2" × 12"	8'	$7.02
2" × 12"	10'	$8.78
2" × 12"	12'	$11.52
2" × 12"	14'	$17.64
2" × 12"	16'	$22.90
Miscellaneous Hardware for one table (nails, screws, bolts)		$20.00

QUESTIONS

2a) By providing a detailed cost analysis, show how you can build the table for under $85.00 including taxes. Specify how you are using the lumber for the different parts of the table. State any assumptions you have made.

Organization of your work will be a factor in marking. (Space for response is provided on the next page.)

Well you will need 5 pieces of 2" x 12" for the seats, and for the top of the table.

You will need 5 2" x 4 for the rest because you can use 1 piece of wood to make 2 legs and 1 piece to make both short supports.

building material		# of items	cost	Total
2"x12"	8'	5	$ 7.02	$ 35.10
2"x4"	8'	5	$ 2.48	$ 12.40
nails			$ 20.00	$ 20.00
				$ 76.95

building materials		# of items	cost	Total
2"x12"	8'	5	7.02	=B2*C2
2"x4"	8'	5	2.48	=B3*C3
nails			20	=C4
				=SUM(D2:D4)*1.14

2b) Two neighbours decide to get together and build two tables. Indicate the specific materials to be purchased, and calculate the minimum cost for building the two tables.

building materials		# of items	cost		Total
2"x12"	8'	10	$	7.02	$ 70.20
2"x4"	8'	10	$	2.48	$ 24.80
nails			$	20.00	$ 20.00
					$ 131.10

7 marks.

- Part a) is correct and complete
- 0 marks for part b)

APPENDIX A

Table of Specific Outcome Match and Item Type

Multiple-choice items				
Question #	Key	Unit	Specific Outcome	Mark
1	C	A	1	1
2	D	A	1	1
3	A	B	1	1
4	B	D	2	1
5	B	D	5	1
6	C	E	2	1
7	A	E	1	1
8	B	G	1	1
9	C	H	1	1
10	B	H	1	1

Restricted-response items			
Question #	Unit	Specific Outcome	Mark
13	B	1, 3	3
14	B	1	2
16	D	1, 3	3
18	D	3, 4	2
21	G	1	2
22	G	2, 3	2
25	H	2, 3	2

Restricted-response with explanation items			
Question #	Unit	Specific Outcome	Mark
12	A	2	4
17	D	4	4
20	E	1, 3	4
23	G	1	3
Inquiry 1	C	1, 3	10

Open-response items			
Question #	Unit	Specific Outcome	Mark
11	A	2	5
15	B	1, 2, 3	6
19	E	1, 2, 3	4
24	H	1	5
Inquiry 2	F	1–4	10

APPENDIX B

Generating Student Profiles

Profile of Test Score by Question Type

Item Type	Test Items	Total	÷ Maximum	× 100	= %
Multiple-choice	1 to 10: ____		10		
Restricted-response	13 ____, 14 ____, 16 ____, 18 ____, 21 ____, 22 ____, 25 ____		16		
Restricted-response with explanation	12 ____, 17 ____, 20 ____, 23 ____, Inquiry 1 ____		25		
Open-response	11 ____, 15 ____, 19 ____, 24 ____, Inquiry 2 ____		30		

Profile of Test Score by Curriculum Unit

Unit	Test Items	Total	÷ Maximum	× 100	= %
Matrix modelling	1 ____, 2 ____, 11 ____, 12 ____		11		
Vectors	3 ____, 13 ____, 14 ____, 15 ____		12		
Personal Finance	Inquiry 1 ____		10		
Probability	4 ____, 5 ____, 16 ____, 17 ____, 18 ____		11		
Variability and Statistics	6 ____, 7 ____, 19 ____, 20 ____		10		
Design and Measurement	Inquiry 2 ____		10		
Periodic Functions	8 ____, 21 ____, 22 ____, 23 ____		8		
Sequences	9 ____, 10 ____, 24 ____, 25 ____		9		